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The ELECTRICAL REVIEW

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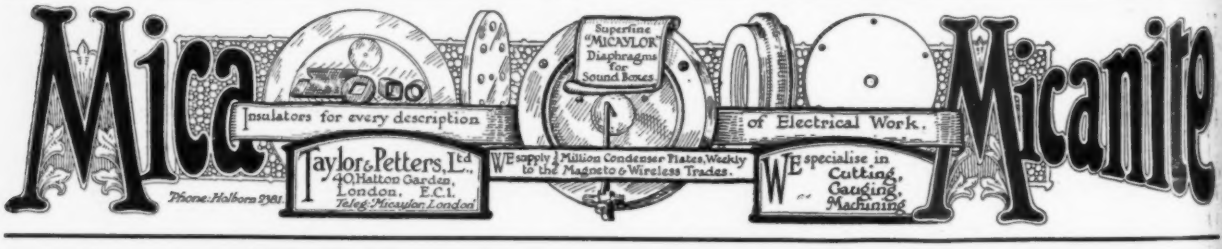
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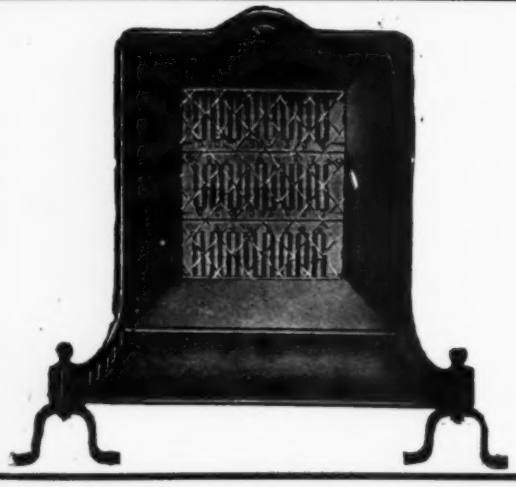

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Adelaide's Electricity Undertaking.

ALTHOUGH the City of Adelaide, the capital of the State of South Australia, is the third largest of the six capital cities of the Commonwealth, it is curious that it appears to be less well known in this country than many of the smaller Australian States and towns. The fact that the city's suburban area comprises 18 municipalities and councils, with a population of 279,000 people, indicates that the electricity supply system, of which a description is commenced elsewhere in this issue, is an important one.

The undertaking is company owned, with statutory powers to supply electrical energy throughout the State—an area of 380,000 sq. miles, roughly the size of England and Wales. The metropolitan area is some 155 sq. miles in extent, all of which is supplied by a single generating station, a striking contrast with the Administrative County of London's area of 62.5 sq. miles and 32 electricity undertakings. The greater distances and sparser population than those we are accustomed to in this country demanded the use of overhead transmission and distribution everywhere, except within the more important city streets, and the whole of the 33,000-volt switchgear and step-up transformers are of the outdoor type, the Osborne installation being the first large-scale one of its type in Australia. At the time when tenders were invited for the apparatus, it was thought that British manufacturers had not sufficiently developed their practice in such outdoor appliances; hence the switchgear and transformers are American, but it is satisfactory to learn that all extensions now in progress are being carried out with British material, and the whole of the generating plant is of British manufacture. It is of interest to note that the undertaking carries an important irrigational load at certain seasons of the year, and that 73 per cent. of the occupied houses in Adelaide are connected to the electricity mains. The company has maintained an annual connection of from 5,000 to 6,000 new consumers to its mains, and the public streets are lighted with electricity exclusively. Does any undertaking in England add new consumers at a similar rate?

In conclusion, it may be pointed out that the tendency of successive Commonwealth Governments seems to be towards increasing the protective duties leviable on such commodities as can be made in Australia; the general result so far as Australian electricity

supply undertakings are concerned, is a continually increasing demand for industrial power. Although imports of electrical plant and accessories are, at present, mainly from England, we learn from Mr. F. W. H. Wheadon, the engineer and manager, that American competition is keen and that the United States is offering apparatus which is, on the whole, more suitable for Australian needs. He feels that British manufacturers ought to study the requirements of the Australian market more closely, lest it should go the same way as the Canadian has gone.

The British Empire Exhibition.

As the time approaches when, in the normal course, the British Empire Exhibition will close its doors, the question whether it shall be reopened next year for a further run has come into prominence in the daily Press. On the one hand, the Exhibition authorities appear to be desirous of carrying on, and Lord Stevenson is reported as having said that to close it would be "insane folly"; on the other, the Dominion Governments with one voice acknowledge that their respective States have derived immense benefit from the splendid advertisement that they have gained, whilst with equal unanimity they declare that they will not take part in it next year, on account of the large expenditure involved. The question, therefore, is very much in the air at the moment.

There are many points of view from which the matter may be considered, and no doubt it will be keenly debated for weeks to come. To the engineering exhibitors the subject is of exceptional importance, on account of the large amount of capital locked up in their exhibits and the heavy cost of attendance. We do not propose at this stage to discuss the pros and cons; we have our own opinion with regard to the matter, and we believe that we could pretty accurately interpret the views of the industry in general. For the moment, however, we propose only to invite those of our readers who are more directly interested in the question to give it their close attention, so that when the time comes to make a decision they will be under no uncertainty as to their proper course of action.

The Wembley Electrical Carnival.

We wish to draw special attention to the announcement which appears elsewhere in this issue with regard to the Electrical Carnival and Dance which is being organised by the exhibitors in the electrical section of the Palace of Engineering: This interesting function is not to be confined to exhibitors or others connected with the exhibition—it is open to everyone connected with the electrical industry in any capacity, and to his relatives and friends. It will, in fact, be the electrical red-letter day of the exhibition year, and will not only provide a unique opportunity for electrical men of every description to forgather, but also will constitute a very notable demonstration to the public. As the I.M.E.A. will meet at Wembley during that week, it is hoped that the members will take part in the Carnival, and assist in making it a memorable occasion.

America and Great Britain.

The interchange of goods between this country and the United States constitutes a bond of union far more effective than any ties of blood or sentiment, and it is pleasing to see that there was no diminution of the volume of trade between the two nations during last year, although we again received from the United States more than twice the value of the goods which we exported to that country.

The report of the British Commercial Counsellor at the Washington Embassy (Mr. J. J. Broderick), which we review in this issue, shows that 1923 was a prosperous year for American industry generally, and the contrast between conditions there, where there was a partial shortage of labour at one period of the year, and here, where the unemployment figures remained at an appalling height, is a saddening indication of the ground lost during the years of war. The position was aptly summarised recently by a writer in the *Electrical World*: "The war is past history in America, but current history in Great Britain."

The United States electrical industry shared in the general prosperity, and at the end of the year was left with sufficient orders in hand to keep it occupied for nearly six months. The industry's hold on foreign markets is being further strengthened notably in Japan, where the Westinghouse Electric interests have participated to a large extent in the formation of a company which will exploit its patents. To penetrate tariff walls, the General Electric Co., states the report, is said to have acquired control over the Canadian concern of the same name. The company has in view the securing of the preferential rates accorded to Empire-made goods wherever possible.

Wages in the electrical industry are high, but in industry generally there has been an increase in labour efficiency, so that the high wages are earned and the industry is enabled to pay them.

There are few indications in the report of new openings for British trade. Now and again, it is said, great opportunities occur when American factories are fully occupied and goods are required within a short time. To enable British manufacturers to take advantage of this, Mr. Broderick hints at the benefits of co-operation and the appointment of an informed representative to make such openings known within a reasonable time. British goods are said to be generally popular among Americans, and the competition of low-priced Continental articles is somewhat counteracted by the consumers' determination to get a good article in spite of the price. Most of this information is of a general nature, but there is no doubt that it applies at many points to electrical goods.

Toujours la Politesse!

Our readers, particularly those who are exhibiting at Wembley, may be interested and amused by the following example of the business methods adopted by the great ones who preside over the British Empire Exhibition.

It should be explained that where sales are made from a stand within the Exhibition, a return showing the amount of such sales has to be furnished to the authorities, who claim a certain percentage on the total. We, unhappily, were some fourteen days late in making our return, due to the fact that August was a holiday month and some of the staff were away.

Most business concerns would be well content if they secured payment by the end of the month in which it became due; not so the financial experts of the B.E.E.

In order that we might be made to realize the enormity of our offence, we received the following gentle reminder which stands, we think, entirely unique as a first intimation that payment is overdue:—

THE BRITISH EMPIRE EXHIBITION (1924), INC.

August 23rd, 1924.

Dear Sir(s),—

I am directed to draw attention to your failure to render a return of the sales effected by you at your Stand for the month ended July 31st, and a remittance for the commission due to this Association. I have further to inform you that unless this return and remittance are received on or before Wednesday next, the 27th instant, your Stand will be closed to the public as from the latter date until such time as you see fit to comply with the regulations.

I would also draw your attention to the fact that this continued breach of the regulations renders you liable to forfeiture of the space occupied by you and to the removal of yourself and your employés from the Exhibition.

Yours faithfully,

H. A. Beckenham,
Secretary.

After all, if it were not for the exhibitors there would be no Exhibition at all, and possibly many of those engaged in its administration would be unemployed. High-handed methods hardly tend to promote that spirit of harmony between exhibitors and administrators which is essential if the Exhibition is to be the huge success that we all hope to see.

The Lighting of Liverpool Cathedral.

By H. NORRIS, Student I.E.E.

THE artificial illumination of an ecclesiastical building, particularly one of such magnitude and importance as the Liverpool Cathedral, one of the largest in the world, presents many problems peculiar to itself, each of which requires careful treatment in order that the general effect may be entirely satisfactory.

The main considerations to be borne in mind are that the degree of illumination shall be sufficient for all purposes without being too intense—too much light producing a sense of drowsiness amongst the members of a congregation—and that, if practicable, every source of light shall be obscured in some manner; and also that the most highly illuminated portion of the building shall be the east or altar end. These requirements point to a system of lighting using reflectors placed on pillars or columns facing the altar, and this was the scheme originally decided upon in the case of the Liverpool Cathedral. However, after several experiments had been carried out, the first trials being made as far back as 1913, it was decided to make some modification in the original scheme, and the completed installation is a combination of reflectors placed against the columns at a convenient height, and of pendant fittings hung directly over the large central space reserved for congregational use and in the aisles.

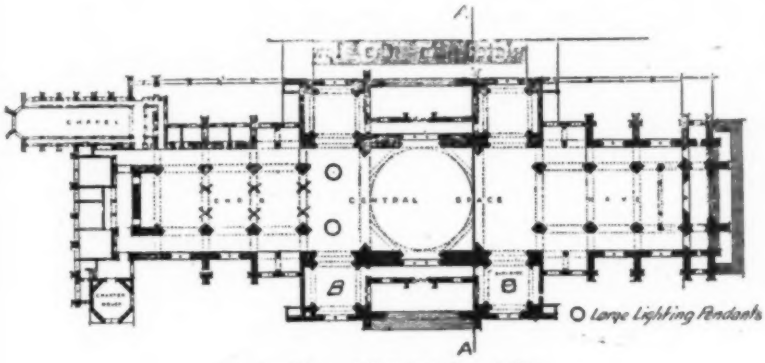

Fig. 1.—Liverpool Cathedral, Ground Plan.

The Liverpool Cathedral has been in course of construction for some twenty years, and in all probability a further twenty or thirty years may elapse before the entire building is completed. The ground plan (fig. 1) shows the whole of the Cathedral. The portion to the left of the line A is that already completed, which was consecrated on July 19th, 1924, the King and Queen being present at the ceremony.

The choir, chancel, and reredos are lighted very effectively by means of twelve batteries of B.T.-H. Mirolux reflector units, two placed upon each of the six columns in the choir (fig. 1 × × ×) at a height of 12 ft.; each unit contains eight vacuum-type 60-candle-power lamps, making a total of 16 lamps per column. Each pair of batteries is contained in carved oak frames which harmonise with the surrounding stonework, fig. 2, the fronts of the units being obscured with sand-blasted and slightly tinted glass; thus by day the lamps are not visible.

Additional light over the choir stalls is arranged for by means of a number of Linolite fittings placed in the canopies. Linolite fittings will be used also for additional lighting in the clergy stalls, the fittings being placed on the stalls themselves.

For the illumination of the large central space, two pendant fittings have been designed, each containing seven 300-watt gas-filled lamps with "X-ray" type reflectors. These give a good general illumination from a height of 35 ft.; fig. 3 shows one of the large pendants. They are made of penny bronze and measure 10 ft. in height, the weight of each being approximately 1 ton. The Western Electric Co., Ltd., has installed an amplifier apparatus in the building, operated from the pulpit, one amplifier being placed in the body of each of the two large lighting pendants, fig. 3.

Means of raising and lowering these fittings for cleaning, &c., purposes have been provided in the roof space, where two special winches are installed against the end wall of the building. The weight of the fittings rendered it impracticable to suspend them directly from the crown of the vaulting, consequently the suspending chains are taken through the vaulting into the roof space, where they are hung from the transverse roof beams, a wire rope used for raising and lowering attached to the chain being taken on to the winches.

The North Transept War Memorial Chapel B is lighted by two reflector units identical with those used for lighting the choir, placed in the angle of each transept gallery so as to effectively illuminate the altar and reredos. Additional light is obtained from four pendant bracket fittings on the wall, two placed beneath each transept gallery. Four identical pendant bracket fittings are placed similarly in the South Transept.

The choir aisles and ambulatory are lighted by pendant bracket lanterns similar to the units composing the large central fittings (see fig. 3). The Chapter

Fig. 2.—Choir Stalls and Oak Framework.

House, vestries (eight in number), and outside porches are lighted by means of bracket or pendant fittings.

In addition to the lighting installation, there is a system of power, or heating, plugs and sockets, one being placed in each vestry and one each in the Chapter House, song room, organ console gallery, on both sides of the choir, reredos, and on two columns in the

nave. Also a number of electromotors for use in connection with the heating and organ-blowing systems have been installed in the basement, together with a 98-h.p.

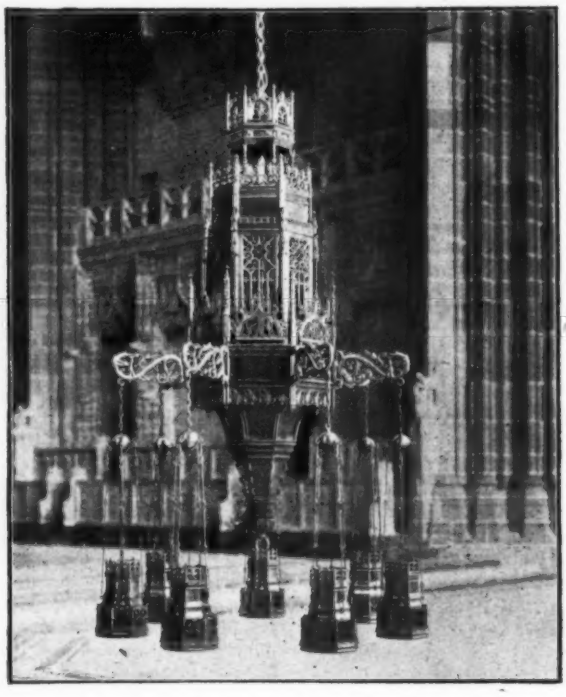

Fig. 3.—A Lighting Pendant and "Loud Speaker."

electric motor and pump for use in connection with the fire hydrant system, fitted with an automatic starter so arranged that by means of small push buttons at each of the seven hydrant positions in the building an almost instantaneous supply of high-pressure water can be made readily available in the event of an outbreak of fire. This Mather & Platt outfit, with control gear by Electric Control, Ltd., was supplied by Messrs. G. N. Haden & Sons. The organ-blowing apparatus, supplied by Messrs. Willis & Sons, is situated in a separate room in the basement of the Cathedral, there being three blowing installations, with Verity motors and Brookhirst switchgear, giving three different wind pressures; also a motor-generator set by Messrs. Cutting Bros., with a Walsall control panel and a battery, was supplied by the Rockingham Engineering Co. for use with the internal mechanism of the organ.

The largest of the Mather & Platt motors in connection with the heating installation is of 35 h.p.; it is used for driving heated air around the numerous ducts in the floor of the building. Vitiated air is extracted by the smaller motors, by which means also water is circulated in the low-pressure hot-water heating system.

The whole of the wiring, excluding that used for the motors, which is enclosed in heavy gauge conduit, has been carried out with the British Insulated and Helsby Cable Co.'s lead-covered, paper-insulated, twin "house" wire, some 10,000 yards having been used; all wires, with very few exceptions, are concealed either in the joints of the stone work or in the numerous heating, &c., ducts which run throughout the building. The runs are long, especially in the case of the large central fittings (100 ft.) and triforium lights (300 ft.).

Reflectors and reflector units were supplied by the British Thomson-Houston Co., Ltd., of Rugby. All the fittings were made by Messrs. Osler & Co., of Birmingham, to the design of Sir Giles Scott, R.A., the architect. The contractors for the whole of the installation are Messrs. John Hunter & Co., of Liverpool, under the direction of Mr. A. Lester Taylor, M.I.E.E., the electrical adviser to the Liverpool Cathedral Committee.

The Effective Range of Crystal Receivers.

By G. G. BLAKE, M.I.E.E., A.Inst.P.

MUCH discussion and many claims have been put forward lately as to the distance at which it is possible to receive signals and broadcast matter with crystal detectors.

So many factors are involved that it is quite impossible when fitting up a station to predict the limit of reception; all kinds of claims are made from all descriptions of stations situated in various directions, so that it is impossible to establish reliable comparisons. Even supposing that we reduce the problem to reception from one well-known and powerful transmitting station, we are still faced with a problem almost impossible to solve.

To commence with, the radiation from the transmitting station is not equal in all directions. This may be due to its possession of directional properties, owing to the shape and direction of its aerial, also to the unequal electrical conductivity of the earth or sea intervening between it and the various receiving stations, or possibly to the presence of hills or buildings in the vicinity of either station.

Another difficulty which presents itself is the very problematical question as to the effective height of the receiving aerial. It is not possible to erect two aerials in two different places, especially on buildings, which will have the same effective height; should such a coincidence occur, it will result rather from luck than from management. Again, all except absolutely vertical aerials are more or less directional, and will receive better from one direction than from another. There is also the possibility of reflection of waves from adjacent buildings, especially buildings with iron roofs; then there is the selection and gauge of the wire employed for both the aerials and the inductances. There is far more "damping" in some stations than in others; the connection to earth is again a very variable factor.

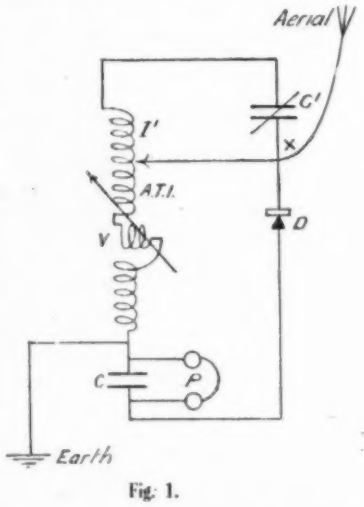

Fig. 1.

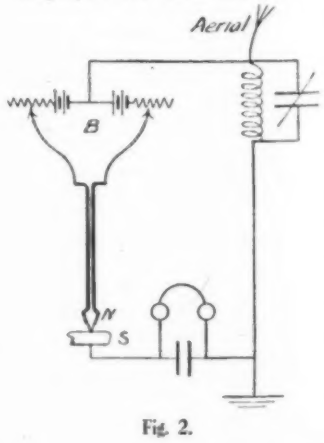

Fig. 2.

Next there is the question which kind of crystal shall be employed, and whether we are using 'phones wound to the ideal resistance to suit the crystal.

The author has experimented with many kinds of crystals since General Dunwoody, in America, introduced rectification by means of a carborundum crystal in 1906. It is very difficult to find two crystals even of the same kind which will give equal results on really weak signals; it is therefore very risky to express an opinion as to which crystals or crystal combinations are the best.

On the whole, the author recommends a zincite-bornite, or a zincite-copper pyrites, contact for long-distance reception; either of these combinations gives louder signals than any others which he has tried, but both are very liable to get out of delicate adjustment in use. Either a galena-platinum (or gold) or a silicon-platinum contact is recommended for all-round working; neither of these combinations is so sensitive as zincite-bornite, but either of them is preferable for permanence.

Another very reliable and permanent detector is made by a contact between a crystal of hertzite (specially prepared galena) and a fragment of iron sulphide.

Another problem encountered when testing crystals for long-distance reception is the choice of circuit.

The connections shown in fig. 1 give very good results. Variable condenser C′ is first set at zero. The aerial circuit, consisting of the crystal detector D, a pair of suitable high-resistance 'phones P (shunted by a small condenser C) and the A T I is first tuned to the transmitting station by means of a variometer V, to maximum signal strength.

A marked increase of signal strength can now be obtained when the circuit C′ I′ X is tuned to resonance with the A T I.

The temperature at the point of contact on the crystal also has a decided effect on signal strength. The author finds that the arrangement shown in fig. 2 gives a slight, but quite decided, increase in signal strength between a platinum and silicon contact. N is a platinum-pointed cautery needle as employed for surgery, heated by means of a small battery B; the tip of the needle rests against a fragment of silicon S.

A slight increase of the temperature of the platinum needle increases the signal strength, but the heating cannot be pushed very far; before red heat is reached, the signals are almost completely destroyed.

In conclusion, it is strange that we now talk about a distance of 50 or 60 miles over land as an achievement, whereas in pre-valve days, ships used to report receptions over distances of hundreds of miles. The first transatlantic reception made by Senator Marconi at St. John's, Newfoundland, was made with a carbon-mercury contact detector of the Thommasina type. In the early days of wireless the ether was comparatively free, and there was far less interference by jamming, so that one could often listen in silence, especially when in some fairly remote place; also in those days the operators were so thrilled with the wonders of this new science that they would strain their ears to hear the faintest of faint signals so as to establish a record, whereas now to be practical they require signals of easily readable strength; this I think is the most feasible explanation, though it has been suggested that with the vast increase of power now being radiated through the ether, it has become so to speak "overworked," and that the old distances are no longer possible without the employment of valves and amplification. The idea is certainly ingenious, but though it is backed by the fact that greater distances can be reached at night when the ether is undisturbed by sunlight, it does not carry any real conviction. The sunlight interference may not be due to etheric effects at all. Is there any ether? Many think there is, and feel that we cannot explain our facts without it. Einstein disregards it, if he does not deny its existence. We are still groping for more positive knowledge in the oceans of infinity; may not the interference effects be caused by the action of the sun and light upon the Heaviside layer or upon the dielectric properties of our atmosphere?

Power Transmission Lines: Aspects of their Design.—III.*

By WILLIAM T. TAYLOR, M.Inst.C.E., M.I.E.E., Fel.Am.I.E.E.

THE formula for minimum spacing s† is for h.d. copper conductors and, in practice, is applicable *only* to short spans up to about 200 ft. No allowance is made for stretching and the uneven swinging of conductors, nor for certain other factors which place a minimum practical limit on the separation of line conductors for different spans. The formula suggested for practical conditions is:—

$$s = x \text{ EK (inches)} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (9a)$$

in which K = coefficient (see Table I†).

E = voltage between line conductors.

x = constant, based on sag, temperature and the span length.

(x)	Span in feet.	Sag at temperature of 120 deg. F.
0.0010‡	100-200	1.0- 3.0 ft.
0.0012	200-300	3.0- 7.0 ,,
0.0014	300-400	7.0-12.0 ,,

Thus, for a 33,000-V, 3-phase line with three No. 1/0 L.S.A. copper conductors equilaterally spaced and giving 8 ft. sag at 120 deg. F., the practical spacing is—

$s = 0.0014 \times 33{,}000 \times 1.13 = 52.2$ inches (say 4.5 feet).

This difference in conductor separation has a marked influence on the line voltage regulation, it being greater the greater the kW load and the longer the transmission distance. Then, for a 12-ft. sag of No. 1/0 conductors on a span of 400 ft., it certainly is, with present methods, unsafe in actual practice to operate on a 36-in. spacing. The practical spacing for such a sag and span is 4.5 ft. The examples in Part I, *in so far as the spacing of conductors is concerned*, are purely illustrative and given only to show the effect of conductor spacing on voltage regulation. Thus, in the last example the practical case is to deal with the greatest sag (12 ft.) at the maximum summer temperature, and it is finally decided to place the cross-arms 54 $(\sqrt{3}/2) = 46.75$ inches below the upper conductor, so that the equilateral triangular spacing between any two of the three wires equals 4.5 ft. Therefore, the actual voltage drop is—

$\sqrt{3} \times 90.48 \times (.55 \times .85) + (.625 \times .5267) \times 25 = 3{,}122$ volts.

Then, voltage at the generating station is $30{,}000 + 3{,}122 = 33{,}122$ volts, and the percentage voltage regulation is—

$$\frac{33{,}122 - 30{,}000}{30{,}000} \times 100 = 10.4 \text{ per cent.}$$

Thus, we have an increase of nearly one-half of one per cent. due to an increase in conductor spacing of

*Parts I and II of this series appeared in the ELECTRICAL REVIEW of May 16th, June 6th, and June 13th, 1924.

†See ELEC. REV., June 6th, 1924, page 909.

‡Also used for cross-arm separation for all spans.

54−36=18 inches from the absolute minimum value, without allowances, given in formula (9).

From Chart II for values of resistance at 60 deg. F. and for inductive reactance values, Charts III and IV have been prepared, with which calculations can be made in terms of the ratio reactance/resistance for different sizes of conductor and for the more common power factors; these charts will be reproduced with the concluding portion of this article.

Lines are usually designed by working out the line voltage-drop and power loss, and the cost of the line (line supports, conductors, insulators, and other parts of the transmission system) for a given set of assumptions as to line voltage and size of conductors and then finding the effect of varying one or the other element to see if a better condition can be found. At the time of design of a transmission line, the actual maximum load and the power factor of the load are rarely known; moreover, the actual length of the conductor is very rarely known with accuracy. When it is considered that there are so many indeterminate variables (neglecting those variables due to costs, depreciation factors, &c.) which vitally affect the electrical performance and economics of a transmission circuit, it would seem that the mathematical solution for determining the *exact* performance is hardly justifiable. Many methods are available for line electrical calculations, but this part of the subject treats with a method involving the ratio: reactance/resistance. Knowing the size of conductor which is obtained from Chart I, and the spacing of conductors which is obtained from formula 9a (p. 349), the resistance and reactance can be found from Chart II.

The ohmic resistance of a conductor may be reduced by any given amount by the addition of more metal (copper), while the inductive reactance is little affected by increasing the size of the conductor: for instance, an increase in the size of conductor which will reduce the resistance-volts by 50 per cent. will reduce the reactance volts only about 5 per cent. For a given metal, the resistance of a conductor is affected by changing the size, the length, the temperature, and the conductivity of the conductor. When the resistance is one quarter as great and the separation of conductors is doubled, the reactance in the line remains the same. The total drop when the power factor of the load is unity, is dependent almost entirely upon the resistance and very little upon the reactance of the line; whereas, at low power factors the reactance is a very important factor in determining the total drop. The maximum range in size of conductors commonly used in overhead insulated lines varies from a No. 7 to a No. 7/0 L.S.G.

The reactance (or reactance-volts per amp.) is a constant if the diameter of the conductor and the distance between the conductors bear a constant relation: for instance, if the diameter of the conductor is doubled and the spacing between any two line conductors of a three-phase circuit is doubled, the reactance is unchanged. Reactance volts increase directly as the line current, frequency, and the length of the line. Reactance is little affected by changing the size of the conductor; it is increased by increasing the distance between conductors, by increasing the kW load and decreasing the power factor, and it is decreased by dividing the sectional area of conductor into a greater number of line-conductors or circuits. In most cases of short lines and large sizes of conductors, the reactance and not the resistance will determine the size and number of conductors or circuits necessary; that is to say, it may be necessary to keep the resistance very low, so that the reactance volts will not be so high as to result in an abnormal voltage drop in the line. There is no fixed ratio of reactance/resistance for all voltages, frequencies and sizes of conductors, but there is a *best* ratio for a given set of conditions, and this is why Chart III should prove helpful in selecting the best ratio.

In the electrical design of power transmission lines it is found more desirable and practical to compute the size of conductors and to determine their spacing for a particular sag, &c.,* in place of calculating the size as must be done when the voltage drop or percentage voltage drop is given. For the latter method, in nearly every case it requires at least one other calculation to determine the voltage regulation for the nearest standard commercial size of conductor. The limiting element in design, or determination of the size of conductor, may be either the voltage drop, the power loss, the temperature rise due to excessive current density, or it may be the mechanical strength of the conductor itself, but usually it is the voltage drop; the common condition, however, is that of not exceeding the permissible limits in any one of the many different particulars entering into the problem.

The size of conductor depends upon the line voltage, the load to be delivered, the distance of transmission, and the permissible voltage drop or power loss. It is chiefly controlled by the allowable voltage drop in the line and in the power transformers. A reasonable value for voltage drop is usually taken around 10 per cent. for the transmission line, and the power transformers at the receiving end of the line are usually provided for this difference; for instance, 33,000 volts at the generating end and 30,000 volts at the receiving end of the line. A 10 per cent. power loss is also commonly taken as a reasonable value for the transmission line itself.

In the determination of power loss and voltage drop, &c., instead of using the formula $I = P/(\sqrt{3}\ E_r \cos\phi)$, use may be made of the ratio $k = RP/(E_r \cos\phi)^2$, (20). These four factors (P, E_r, $\cos\phi$, and R) represent a few of the principal fundamental variables; they invariably form the base data for transmission-line problems. The size of conductor (and its resistance R) depends upon the load P, the voltage E_r, and the power factor of the load $\cos\phi$; the voltage E_r, and the size of conductor will depend upon the permissible power loss or voltage drop and upon the transmission distance. Knowing the value k, then the power at the generating end of the line may be expressed—

$$P_g = (1.0 + k)\ P, \qquad (21)$$

and percentage power loss—

$$p = 100\ (P_g - P)/P. \qquad (22)$$

Chart IV for volts drop e' is based on the ratio of reactance/resistance and the power factor of the load. Knowing the value of e', we have $e'' = ke'$; then the voltage at the generating or sending end of the line may be expressed—

$$E_g = (1.0 + e'')\ E_r, \qquad (23)$$

and percentage regulation—

$$e = 100\ (E_g - E_r)/E_r, \qquad (24)$$

wherein R = ohmic resistance of single conductor; for values per mile of conductor see Chart III.

E_r = voltage at receiving end of line.

P = power in kW at the receiving end of line.

$\cos\phi$ = power factor of the load.

In a.c. systems the ratio between the percentage power loss (p) and the percentage voltage drop (e) varies for the different power factors, frequencies, size, and spacing of line conductors. The ratio of percentages is e/p; wherein e is the percentage regulation, taking the delivered *voltage* at 100 per cent.; p is the percentage power loss, taking the delivered *power* at 100 per cent. A chart can be given showing the values of this ratio for different power factors, frequencies, sizes, and spacing of line conductors in a somewhat similar manner as Chart IV for the ratio of reactance/resistance, but in this case it would be based upon different percentage of e and p; for instance, a chart should give several sets of curves for each power factor at a given frequency, each set of curves to be in terms of size and spacing of line conductors and the ratio of e/p for a given percentage power loss.

By the use of the simple formulæ given above and the Charts III and IV which follow, we are able to determine:—

(1) Line resistance, reactance, and the ratio of reactance/resistance for different spacings and sizes of conductor. (See Chart III.)

*See ELEC. REV., Vol. 94, p. 781, and formula (9a).

(2) Size of line conductor, obtained directly for copper and indirectly for aluminium, &c.

(3) Power in kW at the generating or sending end, after obtaining the value of k from Chart III.

(4) Line power loss and the percentage line power loss.

(5) Voltage at the generating or sending end, after obtaining the value of e' from Chart IV.

(6) Voltage drop and the percentage voltage drop or regulation in the line.

(7) In fact, almost any electrical problem in transmission (for lines up to about 50 miles in length) in whatever aspect the problem may be presented can be solved with the use of these charts.

The charts will be found useful, practical, and sufficiently accurate for all ordinary overhead power lines. They will be found suitable for—

(*a*) Determining the permissible resistance in order not to exceed the desired reactance for any given system and frequency.

(*b*) Determining the reactance directly from its resistance for a given frequency, size, and spacing of conductors.

(*c*) Presenting a visual impression of the relative importance of reactance and resistance.

(*d*) Showing the effect of power factor and the ratio of reactance/resistance on the value of e' (Chart IV), which also shows the maximum respective values of the ratio reactance/resistance; it can also be seen that the value of e' increases with an increase in power factor up to a certain point and then decreases.

(*e*) It will be seen that there is a fixed relation between the reactance and the resistance for a given frequency, size, and spacing of line conductors.

(*f*) That lowering the frequency reduces the reactance and improves the value of e' and the voltage regulation.

(*g*) One can visualise at a glance the effect of frequency and the size and spacing of line conductors on the ratio of reactance/resistance.

(*h*) That the value of reactance can be found by multiplying the resistance by the ratio reactance/resistance values for corresponding size and spacing of line conductors.

(*i*) Showing that, for power factors much above 90 per cent., the resistance voltage predominates in the total voltage drop; and for low power factors the reactance voltage drop is of principal importance.

(*j*) And for showing the effect of current density at low power factor (see Chart III).

In general, it becomes necessary to distinguish between cases where the resistance of the circuit is large or small, as compared with the reactance. With small conductor sizes, the resistance is usually the determining factor of the power transmitted, but with increased conductor size and limited receiver voltage, the a.c. power transmitted is determined by the reactance, and therefore, the ratio of reactance/resistance will have an effect on the power transmission limits as well. For transmission systems having a low ratio of reactance/resistance, the special regulating characteristics of synchronous machines usually become unimportant. The closer the spacing of the line conductors, the greater will be the power transmission limits. The frequency of the power supply also has an important effect on the power transmission limits, more particularly for the transmission of large amounts of power where very high voltage and large capacity circuits are employed. For equal sectional area of conductor, aluminium has a conductivity of 0.6 and a resistance of 1.66 times that of copper; therefore Chart III values are equally useful for aluminium conductors. Current density is $(1/\cos\phi)$ A, wherein A is the sectional area of conductor. With the present ruling prices for copper, the most economic section of copper conductor per ampere is somewhere around that of 0.00125 sq. in., which weighs about 25 lb. per mile and has a resistance of about 35 ohms per mile. Thus, the weight of copper is about 25 lb. (3.3 times more than aluminium for equal area) per ampere per mile, and the corresponding voltage required to supply the power loss over such a conductor is 35 volts; this value (representing the amount that must be lost *economically* in a copper transmission line) is fundamental.

(To be concluded.)

The Measurement of Radio-Frequency and Wave-Length.

The N.P.L. Multivibrator Wavemeter.

In connection with work undertaken at the request of the Radio Research Board, the improvements effected by Mr. D. W. Dye, B.Sc., A.C.G.I., of the National Physical Laboratory, in the methods of measurement of radio-frequency and wave-length are of considerable importance. The multivibrator wave-meter, fig. 1, as now employed for frequency measurements, enables an accuracy within a few parts in 100,000 to be obtained and provides a standard of high precision and of wide application.

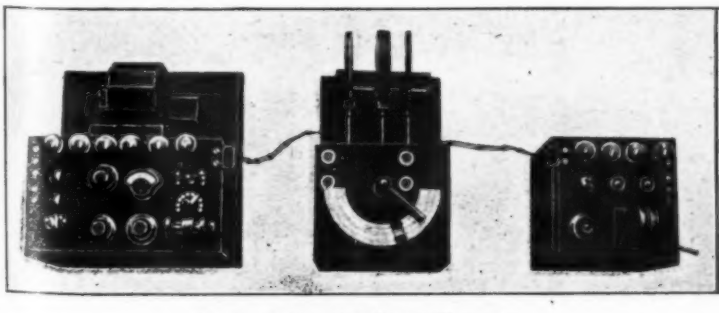

Fig. 1.—A New Multivibrator Wavemeter.

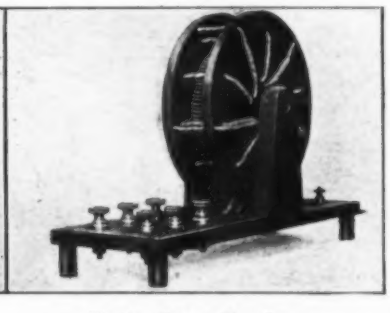

Fig. 2.—Current Transformer.

The work was undertaken in order to secure apparatus suitable for use in the fighting services and, according to the N.P.L. annual report, the instrument has been made up as three separate units, as follows:—(*a*) A compound multivibration unit, consisting of two multi-vibrators in cascade, mounted in one box together with the controlling tuning fork. (*b*) A selector circuit consisting of a specially designed variable air condenser and six stranded wire inductance coils. (*c*) A selective amplifier for amplifying the interference tones resulting from the interaction of the selected harmonic and a local or external radio-frequency source.

The multivibrator unit consists of four items:—(1) A valve-maintained tuning fork having a frequency of 1,000 cycles per second; the fork itself is of elinvar and has a temperature coefficient of frequency of about — 10 parts in a million per

1 deg. C. rise in temperature. (2) A low-frequency multivibrator with fundamental of 1,000 cycles per second controlled by the tuning fork. (3) An intermediate subsidiary selector circuit tunable to frequencies of 19, 20 or 21 kilocycles per second; this circuit is for the special purpose of controlling the high-frequency multivibrator. (4) The high-frequency multivibrator of fundamental frequency which can be varied from 19 to 21 kilocycles by adjustment of the filament current of its valves. When set sufficiently close in frequency to that of the harmonic selected by (3), the high-frequency multivibrator is drawn into synchronisation and then has a frequency entirely governed by the tuning-fork. A change-over switch enables the impulse from either multivibrator to be applied to the selector circuit by means of an inducing coil.

The scheme of connections is shown in fig. 3. The condenser of the selector circuit has moving vanes specially shaped to give a uniform frequency scale. The six inductance coils are designed for constancy, small decrement, and small self-capacity; the three larger coils serve for the low-frequency multivibrator covering the range 10 to 120 kilocycles. The three corresponding scales are engraved on a removable scale plate on the condenser top. The three smaller coils serve for the high-frequency multivibrator covering the range 100 to 1,200 kilocycles; the corresponding scales are on another scale plate, on which the lines and engraving are in red.

The amplifier is coupled by means of an aperiodic coil to the selector circuit. It has a tunable circuit in series in the anode circuit of the first valve and reaction is provided from the anode circuit of the second valve. The two last valves provide audio-frequency amplification. The outfit has three main uses:—(i) To enable a local source to be set to any desired radio-frequency for the purpose of calibration of wavemeters or for any other purpose requiring a steadily maintained source of known radio frequency. (ii) To measure the frequency of received waves from a distant station. (iii) To set the frequency of a transmitting station. The wavemeter is in constant use for all these purposes and enables frequency to be provided, measured, or set to an accuracy of at least one part in ten thousand.

Small Radio-Frequency Voltages.

Mr. Dye has also devised a simple method, indicated in fig. 4, of providing small accurately known voltages at radio-frequencies for use in connection with the calibration of apparatus for the measurement of the strength of received signals and for other purposes requiring such voltages.

Current from a local oscillator passes through the high-frequency milliammeter A and the primary of a radio-frequency transformer T, consisting of a core of thin Stalloy rings wound with a single uniform winding of not less than 100 turns of stranded wire. The primary is one or more turns of wire separated from the secondary. The secondary

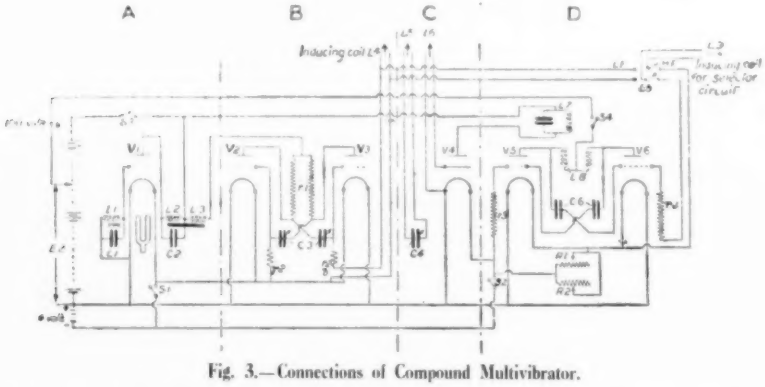

Fig. 3.—Connections of Compound Multivibrator.

of T is effectively short circuited by a not too high resistance R of fine wire. Potential points on R_2 provide a known potential difference e given by the formula $e = IR_2/N$; where I = primary current in amperes. R_2 = resistance connected to the secondary circuit in ohms, and N = ratio—secondary/primary turns on the transformer.

Practical examples of the limits of voltage which may be obtained conveniently are:—(1) Very small voltage $I = 2 \times 10^{-3}$ amp.; $R = 0.1$ ohm; $N = 200$; then $e = 1 \times 10^{-5}$ volt. (2) Moderate voltage, $I = 1 \times 10^{-1}$ amp.; $R = 50$ ohms; $N = 10$; then $e = 0.5$ volt.

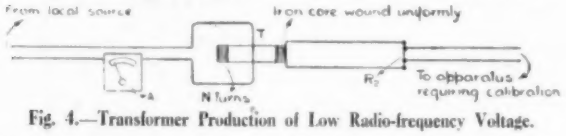

Fig. 4.—Transformer Production of Low Radio-frequency Voltage.

The method is only suitable for those cases where the external resistance or impedance across the patential terminals is large compared with the resistance R. The only condition requiring attention is that the inductance of the secondary winding should make the term $L^2\omega^2$ large compared with the total resistance of the secondary circuit. The method has been used with success in the Wireless Division of the N.P.L. in connection with the research on the measurement of signal strength.

Fig. 2 shows a transformer with three ratios of 100 : 1, 20 : 1 and 10 : 1. The Stalloy core is in an ebonite box and consists of 50 rings having inside and outside diameters of 5.75 cm. and 8.6 cm. respectively. The thickness of the material is approximately 0.25 mm. At the vanishingly small values of H at which such transformers are used, the effective permeability of the thin Stalloy is not very dependent upon frequency or H; it is of the order of 100 in the present case. The secondary winding consists of 100 turns of 27/40 multiple stranded wire. The winding is uniformly distributed round the ring core by the aid of 100 notches cut round the four circular edges of the ebonite box.

The Safety in Mines Research Board.

Second Annual Report.—(*Abstract.*)

The second annual report of the Safety in Mines Research Board has been issued.* It will be recalled that the Board was appointed by the Secretary for Mines in July, 1921, to (*i*) plan and carry out, through its officers and committees, research with regard to safety and health in mines, and to co-ordinate with other investigators; (*ii*) reorganise the experimental station for large-scale research; and (*iii*) advise the Miners' Welfare Committee on the allocation of grants for research work relative to safety and health in mines.

The sum expended by the Board during the 12 months commencing April 1st, 1923, out of funds placed at its disposal by the Miners' Welfare Committee is approximately £13,700.

Mr. George S. Rice, chief mining engineer of the Government Bureau of Mines of the United States of America, visited this country last summer, and advantage was taken to discuss with him research problems. As a result it became clear that great advantage would accrue from systematic co-operation between the research organisations of the two countries. An official proposal to this effect met with the hearty approval of the United States Government, and a detailed plan of co-operation has been worked out.

During the year a scientific staff has been built up, and Dr. R. V. Wheeler was appointed director of the Board's experimental stations and laboratories, in which capacity he will prepare programmes of research and exercise general supervision of all the scientific work undertaken by the Board. Dr. Wheeler will retain his position as a member of the Board, but will be relieved of much detailed executive work by the creation of the post of "scientific executive officer," which has been filled by the appointment of Mr. P. S. Hay.

The ignition of firedamp by heated wires, whilst of importance with respect to the general problem of the ignition of gases, has an immediate practical bearing on the safety of miners' electric hand lamps. The filaments of some kinds of 2-volt lamps as manufactured to-day are capable of causing the ignition of firedamp over a considerable range of mixtures. An account of experiments on this problem made for the Miners' Lamps Committee has been published (May, 1924) as an appendix to the Committee's final report.

An investigation into the mode of construction of flameproof casings for mining electrical machinery is being carried out in co-operation with the British Electrical and Allied Industries Research Association and the Mining Department of Sheffield University. A detailed report on this portion of the research is in preparation, and the trial of electrical apparatus designed for use in coal mines, in order to see how the principles can best be applied, has been undertaken for the Board voluntarily by Prof. D. Hay and Mr. C. I. F. Statham, of the Mining Department of Sheffield University.

The electrical researches are primarily concerned with (*a*) the use of electricity and (*b*) the phenomena resulting from its use. So far as the former class is concerned, the only programme upon which work has been begun is on shot-firing apparatus. Investigations have been put in hand regarding the striking of momentary arcs in closed vessels and the vaporisation of fusible cut-outs, both of which directly concern the design of flame-proof mining electrical machinery. The striking of an arc and the blowing of a fuse within a closed vessel both create a pressure; the former mainly perhaps of a transient character and of electrical (as distinct from thermal) origin, the latter as a direct outcome of the

* H.M. Stationery Office; price 9d. net.

heating effect produced by the electric current that fuses and vaporises the metal. In each instance it is necessary to consider not only the mechanical effect of the pressure produced, but also the added intensity of combustion of an explosive mixture ignited by such powerful means of ignition. It has been necessary to design special apparatus for this work, the most important item, so far as the striking of arcs is concerned, being a recording pressure-gauge capable of registering transient pressures. This has been successfully accomplished.

The Sub-Committee for Research on Electrical Shot-firing Apparatus has submitted samples of the best known types of magneto and dynamo exploders to critical examination, and has found that all, without exception, can be made to produce a spark which will ignite an explosive mixture of firedamp and air when the terminals of the leads are brought together. Experiments are in progress having for their object the designing, if possible, of an exploder incapable of causing a spark that can ignite firedamp. The possibilities of producing a suitable form of battery exploder are also being investigated.

The Mechanical Appliances Committee recommends investigation of the possibility of devising simple apparatus for testing by X-rays the soundness of important parts of colliery equipment consisting of single articles on which men's lives directly depend, such as safety hooks and single links of chain attachments to cages, which might be examined radiographically or radioscopically for bad welds and blow-holes.

The Miners' Welfare Committee having agreed to provide capital for a new large-scale experimental station to replace that at Eskmeals, a site on the Frith, by Harpurhill, near Buxton, is being negotiated for. During 1923 four investigators received grants in aid of research work, as did also Mr. A. G. Gulliford, head lampman at Denaby and Cadeby Collieries, near Rotherham, to enable him to continue work on the development of an idea for a firedamp detector for electric lamps.

New Electrical Devices, Fittings, and Plant.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

The "C-B" Wiring Clip.

A new type of wiring clip has been designed by CALLENDER'S CABLE & CONSTRUCTION CO., LTD., Hamilton House, Victoria Embankment, E.C.4. This is a "T"-shaped tinned brass strip, with a countersunk hole for fixing it to a wall. In use the clip is fixed and the cable placed upon it. The "T" head is bent over the cable and then the body of the clip is taken over. The arms of the "T" are bent back upon the body, and finally the tail is turned back over the arms, giving a tightly-locked joint.

An Ironclad Watertight Socket and Plug.

MESSRS. J. H. TUCKER & CO., LTD., King's Road, Tyseley, Birmingham, have introduced a new 5-amp. 3-pin ironclad watertight plug and socket. The plug has a cast-iron dome with a machined flange at the bottom to engage the screwed brass ring, which tightens up the plug on the socket. The dome has integral with itself at the top, a ring of handy size for the finger to enable the plug to be readily gripped for insertion or withdrawal. In addition the casting includes a screwed nozzle which takes a brass nut and rubber ring to form a watertight gland for the entry of the flexible cab-tire or other cable. The gland is situated on the underside when the plug is in position in the socket on the wall, so that the flexible cable naturally drops in a downward direction on emerging from the plug, thus obviating the risk of damage to the cable by a sharp bend on coming out. The contact pins are carried on a china base having an outer lip holding the watertight rubber ring, this base being fixed into the dome by the earthing pin. The watertight gland is of sufficient size to take circular cab-tire or other cables up to ¾ in. diameter, and an earth terminal is provided on each socket. A brass cap, secured by a chain, is provided for use when the plug is not in use. The bodies of the plug and socket are finished with black enamel. The device is illustrated in fig. 1.

Fig. 1.—A "Tucker" 5-amp. Plug and Socket.

The "Sparta" Crystal Receiver.

Fig. 2 illustrates the "Sparta" crystal radio receiving set which has recently been placed on the market by FULLER'S UNITED ELECTRIC WORKS, LTD., Woodland Works, Chadwell Heath, Essex. Among the special points in the design of this set, the following may be mentioned:—

The aerial terminal is fitted with a removable plug for connecting it to the removable socket of the earth terminal when shutting down the set, as a protection against lightning. The lid cannot be closed until these terminals have been withdrawn. The "cat's-whisker" arm is fitted with universal swivel joints, giving steady flexibility of movement and sufficient rigidity to hold the whisker in position. The crystal-holder has a spring plunger to clamp the crystal in position and allow of its being instantly changed. A dust-proof cover encloses the crystal when it is not in use. The set is provided with a short-circuiting loop, which can be removed and a long-wave coil inserted for receiving from high-power stations when within range.

Fig. 2.—The "Sparta" Crystal Receiver.

Separate earth terminals are fitted for aerials of (*a*) from 30 to 50 ft., and (*b*) from 50 to 100 ft. long. A removable socket fits either terminal plug and the plug aerial terminal.

A Medium-compression Oil Engine.

MESSRS. RUSTON & HORNSBY, LTD., Lincoln, have produced a medium-compression ("Class M") oil engine (fig. 3) as an intermediate type between the well-known "Hornsby" oil engine and the "Ruston" cold-starting patterns. This is a four-stroke engine of simple construction, and is made for outputs of from 8 to 35 b.h.p. The moderate compression suffices to give efficient combustion, which ensures a low consumption with crude and refuse oils. With average fuel oils the consumption ranges from 0.48 to 0.54 lb. per b.h.p.-hour in the larger and smaller sizes respectively. The oil, injected by a pump, enters the vaporiser under sufficiently high pressure to ensure thorough atomisation and absence of carbon deposits in the working cylinder. The starting is easily accomplished; the vaporiser is small, and takes but a short time to heat up. Close governing is attained by means of a highly sensitive governor controlling a mechanically-operated by-pass valve attached to the pump which regulates the

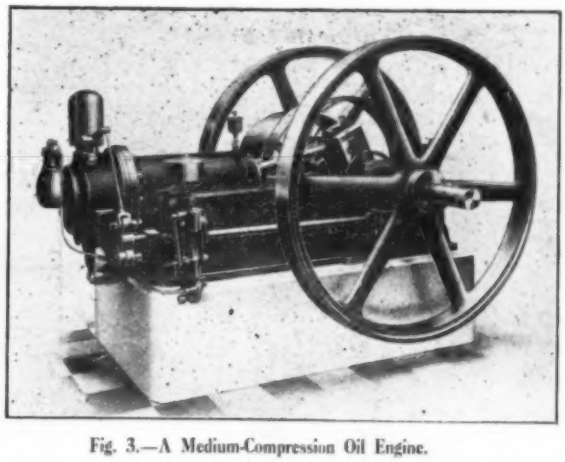

Fig. 3.—A Medium-Compression Oil Engine.

supply of oil fuel according to the load. The engine will run efficiently on a wide range of fuels, including refined petroleum, gas, oil, crude and residual oils, without alteration. Sight feed lubricators supply oil to the gudgeon pin, the piston, the piston rings, and the connecting rod. Rings working in an oil bath provide lubrication for the crankshaft bearings, and also for the side bearings on the larger sizes. Centrifugal oilers fed from a sight lubricator are used for the crank pin. Two flywheels are provided, and a special pulley is supplied when the engine is to be used to drive a generator. The "Class ME" engine, a modification of the "Class M" pattern, is suitable for the direct driving of a dynamo. It has a single flywheel and outer bearing and soleplate. The outer bearing is brought close up to the flywheel, and the crankshaft is extended through the bearing to take a flexible coupling; alternatively the engine can be arranged for belt driving.

The "Goltone" Crystal Set.

The "Goltone" crystal receiving set made by MESSRS. WARD AND GOLDSTONE, LTD., Frederick Road, Pendleton, Manchester, consists of a cylindrical tuning coil set vertically with the crystal detector mounted on the top, and the aerial, earth, and telephone terminals fixed upon the base. Tuning is effected by a slider with two arms, which is raised or lowered

Fig. 4.—"Goltone" Crystal Set.

by an Archimedean screw device. The crystal is enclosed in a dustproof glass case, and the "catswhisker" is mounted vertically above it. All metal parts are nickel plated, and the set is very compact and of pleasing appearance. Tested on a good aerial at a distance of 23 miles from London, the set gave a fairly good reproduction of the "2L.O" programme.

A Home Office D.P.-Switch Lampholder.

A safety holder characterised by exceptional ingenuity has been devised by Mr. J. C. WHITE, A.M.I.E.E., of 49, Bridge Street, Manchester. It is described as "White's patent autogrip Home Office switch lampholder," and possesses several novel features, chief of which, perhaps, is the double-pole switch.

As shown in fig. 5, the lamp-holder consists mainly of composition, which is non-hygroscopic, fire-proof, and insulating, so that it is suitable for use with gasfilled lamps or in positions where extreme local heat is met with. The bayonet socket is moulded into the compound and cannot become alive, nor can it be touched. The cover completely encloses all live parts, and beneath it is the patent "Autogrip" cap, which grips each lead of the flexible separately and firmly, without fear of damage or short-circuit, no matter how tightly the cover is screwed on; the flexible cord cannot be pulled out without breakage, as we have verified, and there is no strain on the terminals. The autogrip cap carries a projection which forms a barrier between the two poles of the switch. In addition to the terminal contacts, the switch consists of three parts of extreme simplicity; as shown in fig. 6, the switch-blades are pivoted in the bases of the lamp-holder spring contacts, and are linked together by a bar of insulating material, which is pushed to and fro by two loose pushbars. These parts can all be removed and replaced in a few seconds, without the use of tools. The operation of the switch depends upon the insertion of a lamp or adapter in the holder, which brings the springs into action and gives in effect a quick make and break.

The use of a double-pole switch complies with the rule that when one pole of the circuit is earthed, switches must interrupt the live lead; to ensure this in the case of s.p. switch lampholders involves testing. The matter is of importance in view of the common use of extensions with plug adapters from lampholders, for portable apparatus, which may be left alive and possibly in a dangerous condition if the s.p. switch happens to be on the wrong lead. The holder is also made without a switch, and both types are suitable for use with ordinary twin, circular braided, or c.t.s. flexible, as well as with standard industrial or domestic shades. The device complies with the new I.E.E. Regulation that lampholders in bathrooms, if not earthed, shall be of insulating material.

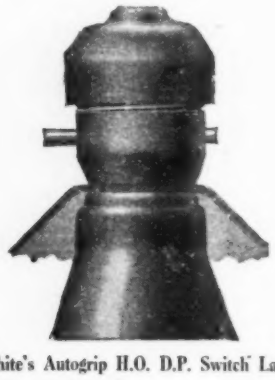

Fig. 5.—White's Autogrip H.O. D.P. Switch Lampholder.

Fig. 6.—Details of Switch-holder.

Correspondence.

Correspondents should forward their communications **at the earliest possible moment.** *No letter can be published unless we have the writer's name and address in our possession.*

Electricity v. Gas.

Allow me to reply to Mr. Bradshaw's letter in your current issue. From his figures therein he would apparently have us believe that by the gas works process it is possible to obtain 1,731 units of heat from one pound of coal in excess of what it contains—an absurd efficiency of 113 per cent.!

Your readers may now estimate the value of the rest of his figures, with which I will not deal.

My figure of 30 per cent. for the maximum thermal efficiency of a gas engine of course referred to the brake efficiency (Otto cycle), while Mr. Bradshaw evidently refers to the indicated.

My figures of 65 per cent. and 20 per cent. were conservative, and I am sure are not exceeded in average every-day practice.

A.M.I.E.E.

September 1st, 1924.

The Prospects of Engineers Abroad.

Would any oversea reader care to give the writer information as to the prospects of well-trained technical and commercial engineers in America or any of the Colonies?

Is it worth while emigrating on the chance of obtaining a post giving scope to initiative and hard work? And at the same time a salary commensurate with the results obtained?

After a long course of ignored answers to advertisements I am becoming convinced that unless one has the necessary influence, or is prepared to wait indefinitely for promotion, it is practically useless to look for such a post in this country—more particularly if one "wasted" five years in the Army during the war. Hence my letter.

Ambitious.

August 30th, 1924.

The Inefficiency of Boiling Rings.

I am obliged to "Cuisinier" for his further letter in your issue of August 22nd, which is of considerable interest. I do not find his two letters entirely consistent, nor do I agree with all he says, but I may have the pleasure of a discussion with him some day, which will doubtless prove of value to us and perhaps to him.

It may interest him and any other of my company's consumers to know that we hire out cookers made by two of the leading makers in the country, and I consider it unjust and entirely incorrect to refer to their products as "out of date."

The ovens of most of the modern electric cookers are just about perfect, and some slowness of the boiling plates is the only possible drawback to electric cooking at the present time. Although we want to overcome this comparative slowness, it is, nevertheless, not of very great importance that it takes, say, five minutes longer to boil a kettle on an electric hot-plate than by others means, so long as one knows and starts five minutes earlier, and so long as small quantities of boiling water can quickly be obtained from a self-contained kettle. This one disadvantage is offset by the other advantages.

Speeding up of boiling is what we all desire, and we ourselves are continually trying out new boiling plates with this in view. Some of those recently produced have proved unsatisfactory, for various reasons, and although it is easy enough to load up the plates, high loading is not everything.

There must be some limit to the number of different makes of cookers hired out by a supply authority, in order to facilitate maintenance. As, however, "Cuisinier" appears to be a consumer with some knowledge of the subject of electric cooking, his experience should be of value, and if he has in mind some electric cooker (made in our own country) which he believes would be more satisfactory than those we now hire, we shall be pleased to obtain one for him and hire it out at a rental not greater than he now pays; all we would ask is that he should make careful observations of its performance and give us his experiences.

I cannot think of a better offer to make to "Cuisinier," and do not propose to carry the correspondence further.

W. F. T. Pinkney,
Engineer, Lighting and Heating Department,
NEWCASTLE-UPON-TYNE ELECTRIC SUPPLY CO., LTD.

Newcastle, *August 26th*, 1924.

I have been following the correspondence in your columns on this subject, and the complaints seem to be directed against the slowness of the boiling plates rather than their thermal inefficiency.

In my own house I have a three-section Bastian & Allen cooking hob or stove, the large centre section of which is loaded to about 2,000 watts. I also have in the kitchen one of my storage geysers giving a constant supply of water at about 150 deg. F., which is used for filling the kettle and saucepans, washing-up, and household purposes generally, apart from baths, which are separately provided for.

I find that 2¼ pints of water drawn from the geyser can be boiled in a Bastalite-coated copper kettle in 7 min. 25 sec. from first switching on, and a second 2¼ pints drawn from the geyser can be boiled over the already heated glowers in 5 min. 9 sec.

In my scullery I have an old gas cooker. I turned the gas on at the meter yesterday, and as the pipes were full of air I had great difficulty in lighting the largest gas ring. When it lit up I gave the flames time to develop, and then put on the same Bastalited kettle filled with 2¼ pints from the geyser. The water boiled in 8 min. 23 sec.

In my house, therefore, water is now boiled more quickly by electricity than it was boiled in past years, when the old gas cooker was used. I emphasise the fact that the gas cooker is an old pattern, but the fact remains that no complaint was ever made that the gas rings were too slow.

The same quantity of water drawn from the cold tap into the same kettle is boiled on the 2,000-watt section of my cooking stove in 10 min. 40 sec., so that 3 min. 15 sec. is saved by using water from the storage geyser, which latter really makes electric cooking economical and practical. It is most wasteful, and a severe tax on the boiling plates, to heat water for washing-up or other purposes in kettles and saucepans. It is usually boiled, and then reduced to the required temperature by the addition of cold water. In most houses only a few pints of actually boiling water are used in a day; all the rest is required at something below 150 deg. F., to which it can be raised with much less heat loss than when it is boiled.

I have never been able to obtain the result Mr. Robert C. Pierce describes with a black-hot stove, such as he must have used in 1899. Red-hot electric stoves were not known until I introduced them simultaneously in England, Germany, and America ten years later. Mr. Pierce will correct me if I am wrong, but my impression is that blackening the bottom of the kettle does not make much difference on a black-hot stove.

C. Orme Bastian.

London, *August 27th*, 1924.

Legal.

An Unlicensed Radio Transmitting Station.

AT the Hemel Hempstead Petty Sessions on August 27th, Arthur C. Hart, described as an electrician, was prosecuted by the General Post Office for installing and operating radio transmitting apparatus without a licence. Accused pleaded guilty, but said that there was no intention to defraud the Post Office.

Mr. GALLAHER, for the prosecution, said that owing to complaints regarding interference from people in the neighbourhood, who were owners of broadcast receiving sets, a search was made, and finally the cause of the interference was traced to Hart's address. Two Post Office representatives paid a visit there, and found apparatus which could only be used for transmitting. Accused admitted that he had a receiving licence only, and that he had transmitted messages on four nights in May.

Mr. Gallaher said that he did not ask that accused should be committed for trial, although the case was regarded as a serious one, but he suggested the imposition of such a penalty as would deter other persons from committing the offence. The case did not merely relate to a technical infringement of the law; the rights of the public had been interfered with and had to be protected. In further evidence it was stated that accused had said that two other persons were concerned in the offence. He also said that no interference with the reception of the British Broadcasting Company's programmes was caused as the transmission took place after midnight on the four occasions referred to.

The Magistrates imposed fines totalling £4.

Cable Stealing Charges.

SENTENCE of three months' imprisonment with hard labour was passed on three young men at Paisley on August 26th for stealing 28 yd. of electric cable, valued at £21 10s., from a haulage house. After stripping the rubber insulation from the cable the accused concealed the copper in a refuse dump at a coal pit. It was afterwards sold to a dealer, who admitted having received and sold the stolen cable. He was fined £10.

A case was recently heard at South Shields, in which the Corporation of that town prosecuted three men on a similar charge, the value of the cable involved being £215. When the adjourned case came before the magistrates on August 26th, one of the defendants admitted having assisted in the removal of the cable, selling it to a dealer. The case was adjourned.

Reviews.

Thermionic Tubes in Radio-Telegraphy and Telephony. By JOHN SCOTT-TAGGART, F.Inst.P., A.M.I.E.E. Second Edition. Pp. xxiv+470; 388 illustrations. London: The Wireless Press, Ltd. Price 15s. net.

The first edition of this book appeared in 1921, and the author has now added a considerable amount of matter which puts the reader in touch with the very latest developments of the subject as set forth in the title. The development of thermionic tubes for purposes other than those of radio communication is not dealt with.

The new matter includes an excellent chapter on recent developments, and an abstract of the author's paper read before the British Association in 1923, which describes his invention for selective reception by increasing at the receiving station the frequency difference between the desired and undesired currents. In the recent developments he describes the Hinton receiving circuit, which is now extensively used by the British Government.

The book is a mine of information not only on present-day practice but on the history of the subject, the latter aspect being greatly enhanced by footnotes giving references to papers, &c., on the matters under consideration.

A pleasing feature of the author's method of exposition is that of following up theoretical explanations by descriptions of practical working arrangements, and the copious use of figures and diagrams is most commendable.

The author is careful to avoid anything in the way of advanced mathematical proofs, and presents the whole subject in a clear and logical manner, which makes it most suitable not only as a book of reference for the engineer, but as a comprehensive text-book for the student.

The Thermionic Valve and Its Developments in Radio-Telegraphy and Telephony. By J. A. FLEMING, M.A., D.Sc., F.R.S. Second Edition. Pp. xiii+438; 280 illustrations. London: The Wireless Press, Ltd. Price 15s. net.

The first edition of this book appeared in 1919 before many of the data resulting from work carried out with valves during the war were at the author's disposal. Since then

all these data have been published, and as the flow of new inventions and adaptations has been unceasing during the last five years, Dr. Fleming has found it necessary to re-write a great part of his former work.

Dr. Fleming is famous throughout the world as the inventor of the two-electrode valve and as one of the greatest authorities, and, fortunately for students, one of the most lucid writers on valve working, not only as a radio-signalling device but also as a telephonic repeater, on which subject he has added in this edition a most valuable chapter.

The book deals fully with the theory of valves having two, three, and four electrodes, and their numerous practical applications to radio communication of the present day, and, as might be expected from the author, the historical aspect of the subject is treated with complete knowledge in a trenchantly direct manner. Most of this historical matter appeared, of course, in the earlier edition, but it is none the less interesting and necessary on that account.

The details of the long-drawn-out controversy between the author and Dr. de Forest are not of immediate interest to the student, and, from his point of view, make the space devoted to the Two-Electrode Valve relatively greater than is essential; but, on the other hand, the progressive arrangement of the whole book is admirably suited to the student's needs. This historical matter on the Two-Electrode Valve is, however, of considerable value to the book as a book of reference, for which purpose it will also be found most useful, as it is an authoritative treatise, well arranged for reference by the inclusion of an index and detailed chapter headings.

The Calculation and Measurement of Inductance and Capacity. By W. H. NOTTAGE, B.Sc., A.M.I.E.E., F.Inst.P. Second Edition. Pages viii+224; 80 illustrations. London: The Wireless Press, Ltd. Price 7s. 6d. net.

This book consists of a collection of formulæ and methods of measurement for inductance and capacity, set out clearly, and well arranged for reference.

In this edition the author has taken the opportunity of including formulæ which have recently appeared, and of adding descriptions of new instruments. A chapter dealing in a simple manner with the proofs of formulæ has also been added.

In addition to the calculation and practical measurement of inductance and capacity, chapters dealing with high-frequency measurements and the appliances used are included. The calculations throughout are given fully, with numerous examples and tables, and require only an elementary knowledge of mathematics for their complete understanding.

This up-to-date book will prove very useful not only to professional radio engineers but also to the ever-increasing body of amateur experimenters.

A Handbook of Telephone Circuit Diagrams, with Explanations. By JOHN M. HEATH, Signal Corps, U.S. Army. Pp. x+279. 72 Plates. London: McGraw-Hill Publishing Co., Ltd. Price 12s. 6d. net.

This pocket-book is the outcome of a need which the author says he felt time and again in his early years of telephone experience for some kind of handbook which could be carried in the pocket and referred to at frequent intervals to obtain a better understanding of the working of the various units in a telephone system.

It is divided into two parts, the first dealing with "Local Battery," and the second with "Common Battery" working. Each of these parts is sub-divided into telephones, switchboards and party lines.

Starting from the simple elements of a telephone system, the author gradually builds the various diagrams up, and explains the process of evolution as he goes along, in order that the reader may be led by easy stages to a grasp of the systems as a whole. The functions of the various items are clearly explained and the diagrams are easy to follow. There are altogether 72 plates in the book, and the main systems dealt with are those of Dean, Kellogg, Stromberg-Carlson, and the Western Electric.

The book will no doubt prove useful to those who, from time to time, require to refresh their memories on the working details of those systems.

Business Notes.

Bankruptcy Proceedings.—A. C. R. BIRKETT, Radio House, 22 & 24, Wheeler Gate, Nottingham, electrical engineer. The first meeting of the creditors was held on August 26th, at the Official Receiver's office, Nottingham. The statement of affairs showed liabilities of £2,000, and assets of £136, leaving a deficiency of £1,864. In a deficiency account dated from July 31st, 1923, debtor returned his net trading loss at £1,116. He attributed his failure to bad trade, want of capital and overstocking. He said that he joined in partnership with another in December, 1922. He contributed £250 to the partnership, which amount he borrowed from a relative and it had not been repaid. The partnership was dissolved on February 1st, 1924, the partner receiving £10 for his share and the debtor taking over all the assets and liabilities, some of which were still outstanding. On February 11th, 1924, he took another into partnership, who agreed to contribute £250 by instalments, but only £150 was paid. Debtor furnished a further £250, borrowed from his father, which he still owed. This business was carried on until June, 1924, when the partner went out, debtor agreeing to repay £150 contributed by him, which amount was still owing. Debtor admitted being aware of his position since August, 1923. The case being a summary one was left in the hands of the official receiver as trustee of the estate.

W. E. MELROSE, Chewton Road, Keynsham, near Bristol, electrical engineer. The first meeting of the creditors of the above was held on August 27th at the Official Receiver's offices, Bristol. The statement of affairs showed liabilities of £394 against assets of £49, or a deficiency of £345. Debtor attributed his failure to bad trade and illness of his wife and children. It appeared that he was employed as an electrical engineer from his demobilisation in 1919 until July 8th, 1922, when he commenced business on his own account with about £30 capital, his savings. At first the business was fairly successful, but about August, 1923, he was sued by a creditor for £170 which was paid by instalments. From this date, he alleged, the business declined, and he had been continually sued by creditors during the last nine months. The case being a summary one was left with the Official Receiver as trustee of the estate. The following are among the creditors:—

	£		£
Moon, A.	77	Frome Engineering Co., Ltd ...	45
Fuller's United Electric Works, Ltd.	57	Sutton & Bridgman ... ... Electrical Power Engineering Co.	41
Edison Swan Electric Co., Ltd....	55	(Birmingham),) Ltd.	36

L. N. STRIBLING and A. E. SETTERFIELD, trading as Stribling and Setterfield, 17, Market Place, Margate, Kent, electrical engineers.—The public examination was held recently at the Guildhall, Canterbury. The statement of affairs showed liabilities of £230 and assets of £56, leaving a deficiency of £174. Debtor Stribling stated that on October 5th, 1923, he and Setterfield commenced in partnership at his present address. They contributed about £60 each as capital, and Setterfield's father-in-law advanced them £100 at five per cent. interest. He also advanced them a further £50 this year. They took on a large contract for wiring a house which cost £40; the shop trade was very bad. Their turnover was £253 in nine months, and they were paying £70 rent and £9 rates per annum, besides 10s. a week for personal expenses. The examination was closed.

RICHARD EMMOTT, electrical appliance merchant and contractor, Croft House, Morton, near Bingley, Yorkshire, late 1, Manor Street, Bradford.—The first meeting of the creditors of the above was held on August 29th at the Official Receiver's office, 12, Duke Street, Bradford. The statement of affairs showed gross liabilities of £714, of which £699 was expected to rank, against assets of £14, leaving a deficiency of £685. Debtor attributed his failure to lack of capital, bad trade, interest on loans and costs, and loss on forced sale by the Sheriff. The case being a summary one was left with the Official Receiver as trustee.

E. COOKSON (W. Turnbull & Co., and the Express Magneto Repair Works), automobile, electrical and mechanical engineer, Elizabeth Street, and Charles Street, Blackpool.—Trustee, Mr. C. H. Plant, Official Receiver, 13, Winckley Street, Preston, released August 7th.

L. BACKHOUSE, C. H. THORNTON, and S. EVANS (Arc Electrical Co.), electrical and wireless supplies, Palatine Buildings, Victoria Street, Manchester.—Last day for proofs for dividend, September 19th. Trustee, Mr. A. T. Eaves, 15, Fountain Street, Manchester.

D. JOHNSON, electrical contractor, 177, Woodhorn Road, Ashington, Northumberland.—First and final dividend of 5s. 4½d. in the £, payable September 10th, at the Official Receiver's office, Pearl Buildings, 4, Northumberland Street, Newcastle-on-Tyne.

J. A. BOSHER, 33, High Street, Aberdare, electrical engineer and contractor.—The first meeting of the creditors of the above was held on August 28th at Cardiff. No statement of affairs was submitted. Debtor attributed his failure to depression in trade, depreciation of stock, and family illness. The meeting was adjourned.

A. W. MATTHEWS and F. G. MATTHEWS, lately trading as the Electrical Gas & Engineering Co., 130, Main Road, Handsworth, Sheffield, electrical, gas, and engineering contractors.—The following are among the creditors:—

	£		£
Morton, W. H.	60	Hallamshire Electric Co. ...	27

P. M. HEALY (Associated Electric Co.), 21, Waterloo Street, Glasgow.—Dividend payable October 6th, at the offices of Messrs. MacLean, Gardner and Aiton, 115, St. Vincent Street, Glasgow.

F. S. BOWEN (Manchester Electrical Maintenance Co., and F. Bowen & Co.), electrical engineer, 7, Brazennose Street, and 43, Thomas Street, Manchester. First meeting, September

4th, at the Official Receiver's office, Byrom Street, Manchester. Public examination, October 3rd, at the Court House, Manchester.

J. COWAN (Cowan & Fox), merchant of electrical appliances, 35, Dickinson Street, Manchester. First meeting, September 3rd, at the Official Receiver's offices, Byrom Street, Manchester. Public examination, October 3rd, at the Court House, Manchester.

Dissolutions of Partnership.—SABERTON & HITCHCOCK, radiological and electro-therapeutical specialists, 1, Springmount, Harrogate.—Mr. C. W. S. Saberton and Mr. C. G. Hitchcock have dissolved partnership. Mr. Hitchcock will attend to debts and continue the business under the same style.

CROWTHER & COULTHARD, electrical and mechanical engineers and contractors, 188, Chapel Street, Salford.—Mr. J. Crowther and Mr. E. O. Coulthard have dissolved partnership. Mr. Coulthard will attend to debts.

MISKIN & RICE, electrical engineers, 1, Long Acre, W.C.2, and 13, Chequer Street, St. Albans.—Messrs. Miskin & Rice have dissolved partnership. Mr. Miskin will attend to debts and continue the business.

BAKER & HYMAN, electrical manufacturers and general engineers, 11-13, Portland Crescent, Leeds.—Mr. W. T. Baker, Mr. H. Hyman, and Mr. L. Hyman have dissolved partnership. Debts will be attended to by Messrs. H. and L. Hyman, who will continue the business under the same style.

Private Arrangements.—E. and W. GOLLAND, trading as Golland Bros., Dale Street, Liverpool, and Chapel Street, Chorley, electrical contractors. A meeting of creditors was held on August 26th at Liverpool. The chair was taken by Mr. O'Brien, of Manchester, representing one of the largest creditors. A statement of affairs was submitted which showed liabilities of £4,126, of which £2,028 was due to the trade and £612 to cash creditors, while there was a claim by the bank for £1,485. The assets, after allowing £179 for preferential claims, were stated to be £671, or a deficiency of £3,455, and consisted of stock, fittings and book debts, the stock being the principal item at the figure of £500. The separate estate of Mr. E. Golland showed liabilities of £783 and no assets, while the separate estate of Mr. W. Golland also showed a deficiency. It would appear that the business was formerly carried on by a Mr. Mackereth and was taken over some years ago by a relative of the present debtors, the latter joining him in partnership in 1919. The present debtors introduced capital of £850 and £900, respectively, and their partner retired from the business in 1922 under an agreement by which he was to receive £620, nearly all of which had been paid. At that time the business would appear to have been in a sound financial position, but the trading loss on the business since the debtors took over the concern amounted to £2,612. It was also stated that as several creditors had sued and were practically in a position to levy execution, a deed of assignment had been executed to a Manchester trustee, in order to protect the assets. It was also stated to the meeting that if the deed of assignment was adopted by the creditors, Mr. Golland, Senr., who was a cash creditor, would waive his claim against the estate. It was pointed out that this would enable the estate to show something like 5s. in the £. It was resolved to approve the deed of assignment already executed to Mr. Poppleton, of Manchester, as trustee, subject to certain of the cash claims already referred to being withdrawn and a committee of inspection was appointed representing three of the principal creditors. The following are creditors:—

	£		£
Sutton, C. A., & Co.	67	Electrical Supplies, Ltd. ...	768
General Electric Co., Ltd. ...	41	Wadsworth Sellers, Ltd. ...	25
Downes & Davies	70	O'Brien, R., & Co.	180
Falk, Stadelmann & Co., Ltd....	22	Lightfoot Bros.	29
Metropolitan-Vickers Electrical Co., Ltd.	44	Oldham & Son	30
Tudor Accumulator Co., Ltd. ...	81	Fleming, A.	24
Callender's Cable & Construction Co., Ltd.	62	Greengate & Irwell Rubber Co.	45
Macintosh Cable Co., Ltd. ...	57	Poppleton, H. K.	51
Marconiphone Co.	73	Bankers	1,485
		Mr. Golland, Senr.	475
		Barclay, A., & Co.	137

F. P. SANDERS, F. G. BLACKWELL, and A. R. FEAR, trading as Sanders & Co., 2, Warwick Road, and 18a, Park Street, Bristol, watchmakers, jewellers, and wireless dealers.—The creditors interested herein were called together recently at Bristol, when a statement of affairs was presented which disclosed liabilities £821, all due to unsecured creditors. The net assets totalled £960, the surplus of assets over liabilities being £139. A resolution was passed accepting a composition of 10s. in the £, payable by three equal instalments at four, eight and twelve months, secured by the execution of a deed of assignment and composition in favour of Mr. W. A. J. Osborne, of Messrs. Corfield & Cripwell, Finsbury Pavement, E.C., as trustee. A committee of inspection was also appointed.

Company Liquidations.—ATKINSON, LLOYD & Co., LTD., electrical suppliers, 15, Blackfriars Street, Salford.—A meeting of the creditors of this company was held on August 21st at Manchester, when the chair was occupied by Mr. Norman Wood, of Manchester, who stated that he had been appointed to act as the liquidator in the voluntary liquidation of the company. The statement of affairs presented disclosed liabilities of £1,031, of which £932 was due to the trade, and £100 to a cash creditor. In addition there were debentures and interest amounting to £412. The total assets were £1,036, from which had to be deducted £104 for preferential claims, and £412 for debentures and interest, leaving net assets of £520. The company was formed in 1916 with a capital of £1,000, and up to 1921 profits had always been made. During 1921 and 1923, however, bad debts were incurred amounting to over £600, and it was to these, coupled with bad trade, that the directors attributed the present position of the company. In February last debentures amounting to £200 each were issued to Mr. Atkinson and Mr. Lloyd; the consideration was cash advanced at that time. In June last Mr. Atkinson put another £100 into the business, and was now an unsecured creditor for that amount. After some discussion it was decided to confirm the voluntary liquidation of the company, with the present liquidator. The following are creditors:—

	£		£
Electrical Apparatus Co., Ltd. ...	26	Ward & Goldstone, Ltd.	22
Crowther & Osborn	22	Castle Engineering Co.	37
Sloan Electrical Co.	25	Jackson, H. A.	35
Edison Swan Electric Co., Ltd....	24	Star Lamp Co.	24
General Electric Co., Ltd. ...	108	Hart Accumulator Co., Ltd. ...	44
British Thomson-Houston Co., Ltd.	58	Longmoor Bros.	57
British Driver Harris Co. ...	54	Metropolitan-Vickers Electrical Co., Ltd.	24
Macintosh Cable Co., Ltd. ...	18		

GRAY ELECTRICAL CO., LTD.—Particulars of claims to be sent to the liquidator, Mr. W. A. J. Osborne, 119, Finsbury Pavement, E.C., by September 27th.

ELECTROPEDS, LTD.—Winding up voluntarily. Liquidator, Mr. F. Ellen, 12, Water Lane, Brixton, S.W.

PORTARLINGTON ELECTRIC LIGHT & POWER CO., LTD.—Following a payment of the first dividend in this matter, the liquidator (Mr. M. J. A. Purtill, College Green, Dublin) will proceed, after September 6th, to a payment of a final distribution of the estate.

Trade Announcements.—MESSRS. SUTCLIFFE BROS. AND BRYCE, LTD., Globe Works, Hyde, have acquired and incorporated in their company the boiler covering business of Messrs. W. J. Hockey & Co., of Cardiff. Mr. W. J. Hockey has joined the board of Messrs. Sutcliffe Bros. & Bryce, Ltd., and will manage this branch of the business as heretofore. The address of the new branch will be:—Sutcliffe Bros. and Bryce, Ltd., W. J. Hockey & Co. Branch, Hodges Row, Docks, Cardiff.

Mr. GEORGE OSBORN informs us that he has ceased to represent the General Accessories Co., Ltd., and has opened a business at 55, Berners Street, W.1, as an electrical manufacturers' agent.

Messrs. BATES & WINDIBANK, London and South of England distributors for Messrs. F. & A. Parkinson, Ltd., and Flather and Co., Ltd., have removed from Southampton Row to larger premises at 140, Southwark Street, S.E.1. Telephone: Hop 6977; telegrams: "Phasamotor, Boroh, London."

ELECTRICAL INSTALLATIONS, LTD., informs us that it has disposed of its holding in Wireless Service, Ltd., and is now not connected with that company in any way.

THE CROYDON ENGINEERING CO., LTD., Victory Works, Gloucester Road, Croydon, announces that it has purchased the goodwill, stock, machinery and plant, lease, &c., of the Messrs. Scholey & Co., Ltd.

A limited partnership (seven years) to undertake the manufacture of electrical accessories at Birmingham has been registered under the title "E. A. MANUFACTURING CO." The general partner is Mr. H. L. Smith, Nechells, Birmingham; the limited partners are Messrs. H. and L. Smith, C. W. Parsons, and J. Etchells, all of Erdington, Birmingham. Each partner contributes £200 in cash.

Catalogues and Lists.—MESSRS. BELLING & CO., Derby Road Works, Montague Road, Upper Edmonton, N.18.—A profusely illustrated catalogue dealing mainly with electric fires, but also with kettles, immersion heaters, hot plates, and other appliances. Priced.

THE CONSOLIDATED PNEUMATIC TOOL CO., LTD., Egyptian House, 170, Piccadilly, W.1.—Two illustrated pamphlets advertising pneumatic hammers and reamers.

CALLENDER'S CABLE & CONSTRUCTION CO., LTD., Hamilton House, Victoria Embankment, E.C.4.—A pamphlet describing and illustrating the "C-B" wiring clips.

MESSRS. A. J. STEVENS & CO. (1914), LTD., Wolverhampton.—A priced and illustrated folder dealing with the company's radio receiving sets of various patterns and accessories.

MESSRS. HOGAN & WARDROP, 88, Golden Lane, E.C.1.—A fully illustrated catalogue of electric fans of several types, desk, ceiling, bracket, &c., and accessories. The list also deals with fractional h.p. motors.

MESSRS. PETTERS, LTD., Westland Works, Yeovil.—A well-illustrated brochure containing full particulars of the company's surface-ignition type cold-starting engines.

THE BENJAMIN ELECTRIC, LTD., Brantwood Works, Tariff Road, Tottenham, N.17.—An illustrated booklet dealing with the illumination of factories, offices, &c.

CENTRIFUGAL CLUTCHES, LTD., 32, John William Street, Huddersfield.—An illustrated folder advertising the "Lydall" clutch.

MESSRS. MICKELWRIGHT, LTD., Alperton, Wembley, Middlesex.—An illustrated pamphlet containing details of resistance apparatus of several types—fan regulators, shunt regulators, dimmers, &c.

THE BRITISH THOMSON-HOUSTON CO., LTD., Rugby.—Price Lists No. 5,270, illustrating and describing 3-phase auto-transformer starters for squirrel-cage induction motors; and No.

5,610-Section 2, dealing with a.c. contactor control equipment for reversing polyphase slip-ring induction motors.

THE ELECTRO-DYNAMIC CONSTRUCTION CO., LTD., Malt Street, S.E.1.—An illustrated pamphlet giving details and prices of converters for battery-charging purposes.

MESSRS. HANS RENOLD, LTD., Burnage Works, Didsbury, Manchester.—A new price list of chains for general engineering purposes.

THE EVER READY CO. (GREAT BRITAIN), LTD., Hercules Place, Holloway, N.7.—A well-illustrated, priced catalogue of the firm's products, including dry batteries, hand lamps, cycle lamps, fans, lamp bulbs, &c.

THE NEW ITALIAN ART ASSOCIATION, LTD., 38, Newman Street, W.1.—A leaflet giving details and prices of "Perlray" glassware lighting fittings.

ROSE BROS. ELECTRICAL CO., LTD., 25, Milton Street, E.C.2.—An illustrated catalogue of flash lamps, accumulators, model motors and dynamos, bell material, and other electrical accessories, with a separate net trade price list.

SUPERLAMP, LTD., 197, Old Street, E.C.2.—A net trade price list of electrical material, including cables, wires, conduit, switches, lighting fittings, &c.

THE BRITISH THOMSON-HOUSTON CO., LTD., Crown House, Aldwych, W.C.2.—An illustrated catalogue of "Mazda" lamps of all types, including vacuum, gasfilled, coloured, traction, and automobile lamps.

THE CAMBRIDGE INSTRUMENT CO., LTD., 45, Grosvenor Place, S.W.1.—A mailing card advertising the firm's publication, "Cambridge Engineering Instruments."

Irish Free State Electrical Imports.—The following table shows the total value of the electrical imports into the Irish Free State during the five months ended with May last and the amount attributed to Great Britain and Northern Ireland. It is pointed out in the official returns that the values show the quantity of goods consigned from the countries mentioned and that it does not follow that they are all of British manufacture:—

	Total Imports. £	Amount attributed to Gt. Britain and Northern Ireland. £
Electric wires and cables ...	29,580	25,024
Telegraph and telephone instruments	18,652	18,548
Electric lamps and parts ...	7,161	6,342
Batteries and accumulators ...	6,024	5,316
Electric lighting accessories and fittings	10,397	9,894
Radio sets and apparatus ...	65,423	64,344
Other electrical goods and apparatus	52,681	50,544
Electric generators	3,751	3,672
Electric motors	8,005	7,663
Other electrical machinery ...	15,061	14,715
Totals ...	£216,735	£206,062

Local Exhibition.—PLYMOUTH.—A radio exhibition is to be held at the Guildhall from September 17th to 24th. Prizes will be awarded to local amateurs for the best receiving sets displayed.

British Empire Exhibition Notes.—In order to attract people to the Exhibition at night, the authorities have decided to reduce the admission charge to 1s. after 5 p.m. It is hoped that this concession will bring the weekly attendance up to 1,000,000 during the final period of the Exhibition.

To draw visitors to those parts of the Exhibition which hitherto have been comparatively poorly attended, the Controller of Publicity is organising a series of daily "treasure hunts," in which the securing of ten "clues" in various parts of the Exhibition will result in a visitor's obtaining a valuable prize. Further details can be obtained from the Controller of Publicity, Press Club, Palace of Industry, and offers of assistance from exhibitors are invited.

Sierra Leone Trade.—The *Board of Trade Journal* reports that the import trade of Sierra Leone increased from £1,511,496 in 1922 to £1,949,981 last year. One of the principal single items in the import list was telegraphic materials valued at £63,502.

Russian Notes.—*Rural Electrification.*—At a recent meeting of the Electric Rural Construction Company it was announced that all the shares, amounting to 2,000,000 roubles, had been allotted, mostly to State institutions. The Allmänna Svenska Elektriska Aktiebolaget is credited with having subscribed for shares for 250,000 roubles.

The Working Capital of the Trusts.—An inquiry has been made into the situation of the working capital of the trusts, the investigation having been made by the General Electrical Commission in conjunction with the Trust Revision Committee. It has been ascertained that the Weak Current Trust suffers from such a scarcity of capital that it is unable to develop the production of telephones, telegraphs, &c., to meet the requirements of the home market. Some inadequacy of funds also exists in the case of the Central Electrical Trust, but the capital of the Accumulator Trust would be sufficient if the War Department were to pay its debts. On the other hand, the concern best situated from the working capital point of view is the Leningrad Electrical Machine Trust.

Textile Mill Electrification.—The executive department of the directors of the Central Administration of Industry had under consideration early in August the question of the electrification of the textile mills in general, although some of these undertakings are already beginning to avail themselves of the supply of energy from existing stations. In this connection it was stated that the managers of the Schatur and Kashir stations have prepared a scheme of industrial electrification based upon a load of 145,000 kW, of which 80 per cent. is required by textile mills. It was submitted that the textile undertakings should participate in the financing of the power stations, for which some 15,000,000 roubles is required, and the mill authorities were asked to consider how far they would be able to co-operate in the matter.

A Large Turbine Order.—According to the *Elektrotechnische Zeitschrift* (Berlin), the contract for eight vertical shaft turbines of 85,000 kW for the Volkov hydro-electric station near Leningrad has been placed with the Nydqvist and Holm Aktiebolag, of Trolhattan, Sweden. It is also stated that part of the contract for generators has been secured by the Allmanna Svenska Elektriska Aktiebolaget, of Stockholm.

Unemployment Grants.—The third interim report of the Unemployment Grants Committee covers the period from October, 1921, to June, 1924. The bulk of the loans approved relates to non-revenue-producing schemes and amounts to £31,006,705. Revenue-producing undertakings were granted a total of £17,161,546, and of this electricity undertakings received £4,493,530, and tramways £2,706,183. Between December, 1920, and June, 1924, among the schemes approved on the basis of 60 per cent. of the wages cost, were: tramways, £311,300, and electricity undertakings, £57,296.

Indian Import Trade.—The Senior Trade Commissioner in India (Mr. T. M. Ainscough, O.B.E.), has forwarded to the Department of Overseas Trade a survey of the import trade of India during the three months April—June, of the current year. In the course of the report Mr. Ainscough says that the steady reduction in the imports of machinery and millwork which has taken place during the past three years continues. The value of the total imports during the quarter fell from 608 lacs to 373 lacs. British shipments were reduced from 531 to 308 lacs, those of America from 56 to 47 lacs, and of Germany from 10 to 7 lacs. The imports included electrical machinery valued at 55 lacs as against 61 lacs in 1923, and boilers to the value of 15 lacs as against 32 lacs. The imports of electrical instruments and apparatus were materially reduced from 76 to 46 lacs. British shipments fell from 63 to 31 lacs, but those from Germany rose from 4 to 5 lacs, from Italy from 1 lac to 2 lacs, and from the U.S.A. from 3¼ to 4¼ lacs. The principal reductions in the British share of the trade were in cables and telegraph and telephone apparatus.

Chinese Notes.—Chinese merchants in Hankow are promoting a tramway company with a preliminary capital of $2,000,000, to construct a line about 50 li (20 miles) in length and to run railless cars. A plan has been submitted to the Civil Governor for approval.

The Dairen tramways operated by the South Manchuria Railway Company are being extended to cope with the rapidly growing needs of the port. During the last financial year the company devoted 800,000 yen to the extension and improvement of its lines, and a further 400,000 yen to be set aside for the current year will bring the total expenditure up to 4,500,000 yen.

The chief engineer of the Chu Chwan Electricity Supply Co., Ltd., has prepared a scheme for the reconstruction of the Chungking lighting system.

It is proposed to form a company under the title of the Yu Pei Electric Light Co. to provide electric lighting in Kiangpei.

The Wuyi Electric Light Co. has been formed, orders for plant have been placed, and the company will commence to supply electricity in Chekiang at an early date.

The Ministry of Communications is to erect a telegraph line between Hsuchow and Haichow in the Kiangsu Province.

Swiss Foreign Trade.—The foreign trade of Switzerland for the first half of the current year was reviewed in a recent *Board of Trade Journal*. Regarding imports, the only definitely electrical item mentioned was "electrodes," the imports of which were said to have increased from 1,748 to 6,011 tons. The imports of copper bars rose from 3,886 to 5,786 tons, but aluminium fell from 49 to 48 tons. Although the machine industry would appear to have had a favourable period, judging from the quantity of goods exported, the total of which was 6 per cent. greater than that for the first half of the last pre-war year, a number of Swiss firms have been obliged to execute their orders at a loss, low prices being essential in order to obtain foreign orders. Exports of locomotives rose from 133 to 3,101 tons, and those of dynamo-electric machines from 2,247 to 2,781 tons. As compared with the first half of 1923, exports of boilers, dynamos, and motors increased by 50 per cent. There was a considerable increase in exports of aluminium, both in bars, at 5,713, as against 3,251 tons, and as a finished article, at 479, as compared with 274 tons in January-June, 1923.

New French Company.—La Société de l'Appareillage Electrique de la Seine has been formed at Courbevoie (149, Rue Armand Sylvestre), near Paris, with a capital of 1,400,000 fr., to acquire and carry on the electrical engineering business of Germain Hezez & Co.

French Company's Progress.—The Compagnie d'Entreprises Electro-Mécaniques reports an expansion in business in 1923 as compared with the previous year. Besides having received orders for four 150,000-V transformer stations for the Southern Railway (France), the company installed plant in Spain and studied the utilisation of water powers both in France and abroad, although these schemes were for the most part still the subject of negotiation. The electric ploughing operations were continued, but progress was hindered by the reserve manifested by the farmers who are still not very familiar with the apparatus. However, the results show increased interest in this application and afford good prospects.

Conditions in Jugo-Slavia.—The Commercial Secretary to the British Legation, Belgrade (Capt. E. Murray Harvey, O.B.E., M.C.) has forwarded to the Department of Overseas Trade a report upon the economic and industrial conditions in the Serb-Croat-Slovene Kingdom (Jugo-Slavia) (Stationery Office. 2s. net). The report is devoted largely to finance and taxation, and the sections relating to industry deal principally with agriculture, timber production, and mining. The production of copper is shown to have increased from 3,567 metric tons in 1921 to 5,592 tons in 1922, and that of lead from 4,829 to 7,673 tons. Great Britain's share in Jugo-Slavia's imports rose from 7 per cent. in the first six months of 1920, to 8.6 per cent. in the equivalent period of 1923. Upon the export side Great Britain took 2.3 per cent. of the total for the first ten months of 1923. With the cessation of reparation deliveries from Germany and in view of the higher German prices, the prospects of the sale of British machinery and metal goods are considered to be more promising. Regret is expressed in the report that British exhibits at the important trade fairs have been very few in number. French radio interests are negotiating for a broadcasting monopoly, and the Cie Générale de Télégraphie Sans Fil has secured a contract for the erection and part operation of a new radio station. Other stations are contemplated for future requirements.

The British Consul at Zagreb (Mr. G. T. McLean) reports that there is a demand in that district for scientific instruments and electrical machinery and fittings. He also states that a contract has been given to Germany for an automatic telephone system for 10,000 subscribers, and that the erection of a broadcasting station is mooted. Mr. C. A. Greig and Count H. Stenbock, of the Sarajevo Consulate, make mention of water-power developments in Bosnia and Herzegovina. It is estimated that about 810,000 h.p., with a possible further 300,000 h.p., is available. Only about 50,000 h.p. of this is in use, but several hydro-electric schemes are being discussed.

An appendix to Capt. Harvey's report shows that under the heading "Machines, apparatus, electrotechnical articles, and vehicles" 18,323,547 kg. of goods, valued at 260,084,382 dinars (100 dinars=5s. 6d.) was imported between January and June, 1923.

Catalogues Wanted.—MESSRS. LEONARD TOOMER & Co., 54, Lower Thames Street, E.C.4, ask for catalogues of electric lighting and radio supplies.

Unemployment.—The Employment Exchange registers recorded a further large increase in the number of unemployed persons on August 18th, the total being 1,222,200, as compared with 1,091,700 a week earlier. The aggregate is still 163,423 lower than the figure recorded at the beginning of the year.

Metropolitan-Vickers in Rumania.—The *Financial News* states that it is reported from Bukarest that Mr. A. Simon, engineer of the Metropolitan-Vickers Electrical Co., Ltd., has arrived there, and intends to inspect the oilfields with the view of elaborating a scheme of electrification.

Book Notices.—"Results obtained over very long distances by Short Wave Directional Wireless Telegraphy, more generally referred to as the Beam System," by Senatore Guglielmo Marconi, G.C.V.O., &c. London: Royal Society of Arts. This is a reprint of a paper read before the Royal Society of Arts in July, and abstracted in our issue of July 25th (p. 155).

"The *Bulletin* of the British Cast Iron Research Association." July, 1924 (34 pp.). Birmingham: The Association.—This issue of the *Bulletin* contains a list of the various research sub-committees of the Association, short reports on recent investigations, a bibliography of works on cast iron and allied matters, and abstracts of recent papers and articles.

"Memoirs of the College of Science, Kyoto Imperial University." Vol. VII, No. 4 (123 pp.). Kyoto: Maruzen Co., Ltd. Price, yen 2.30.—This publication contains a number of mathematical, physical, and chemical papers in English and German.

"Electrical Design of Overhead Transmission Lines," by W. T. Taylor and R. E. Neale. Pp. vii+266; figs., 25 plates and 48 tables. London: Chapman & Hall, Ltd. Price, 21s. net.

B.T.H. Works Extension.—It is reported that the British Thomson-Houston Co., Ltd., is extending its Willesden works and in this connection has placed an order with the Cleveland Bridge & Engineering Co., for a steel-frame building measuring 450 ft. by 140 ft. by 140 ft.

For Sale.—The electrical and mechanical officer, Western Command, Chester, invites offers for one 5.6 Crossley gas engine generating set. (See our advertisement pages to-day.)

Electricity Supply Workers' Wages.—The first meeting of the special tribunal appointed to investigate the circumstances attending the claim of electricity supply workers for higher wages, and the employers' refusal of these, was held on August 27th. The tribunal merely discussed procedure and it was decided that future sessions should be open to the public.

Canadian Copper and Lead Production.—A review of the Canadian mining industry during 1923, which appeared in the last issue of the *Board of Trade Journal*, shows that the output of copper was more than twice that of 1922, the figure being 86,881,537 lb., as against 42,879,818 lb. Production was still lower than in the four years 1915-18, however. The output of lead increased by 19 per cent. to 111,234,466 lb.

Canadian Trade Commissioner.—The address of the British Trade Commissioner at Toronto is now 901-2, Bank of Hamilton Building, 67, Yonge Street.

German Electrical Exhibition.—The fifth electrical and machinery fair at Hamburg will be held in the exhibition hall at the Zoo from September 25th to 30th. Particulars may be obtained from W. A. C. Keim, Messebüro, Hamburg 1, Plan 9.

Lead.—Messrs. James Forster & Co.'s letter of August 30th says:—"Closing prices yesterday were £32 13s. 9d. for August and £32 3s. 9d. for November, against £32 16s. 3d. and £32 5s. respectively at the end of last week. The market as a whole this week has been on the dull side with only slight changes in values and very little interest shown in the metal by consumers. The lowest prices paid were on Tuesday, when sales were made for August from £33 to £32 10s., and £32 2s. 6d. to £31 15s. for November. Supplies continue to come in: the total this month for Liverpool and London alone will be about 20,000 tons by the 31st. Consumption is undoubtedly good, the electrical trades being fully employed and likely to remain so for the remainder of this year. The most optimistic estimate of the total present consumption of lead in this country is just over 18,000 tons per month, and as supplies even without any Mexican lead are fully equal to this figure, prices are high enough. We are informed that America will continue to ship lead freely to Europe."

Markets for Radio Apparatus.—Confidential reports on markets for radio apparatus have been prepared by the Department of Overseas Trade from information received from the British Consul at Helsingfors (Mr. C. H. Mackie); the Acting Senior Trade Commissioner in Australia (Mr. A. Simpson); the Commercial Secretary at Warsaw (Mr. R. E. Kimens, C.M.G.); and from officers in Latin-America.

Winter Lighting "Campaigns."—In preparation for the ensuing lighting season the SIEMENS & ENGLISH ELECTRIC CO., LTD., has produced a number of aids to retailers of its lamps. These comprise a 16-sheet poster depicting a "beefeater" which is already making its appearance on the hoardings; a coloured showcard, "The Crystal Gazer," presenting the picture of a fair lady gazing over a "Siemens" lamp; an art blotter with the foregoing design and a calendar; and four illustrated leaflets. In addition to these the firm is issuing two catalogues dealing with gasfilled and vacuum lamps, and it is also supplying to dealers two electrical games, and lending them illuminated window signs.

The BRITISH THOMSON-HOUSTON CO., LTD., has also made similar preparations. Its publicity methods include the issuing to retailers of a circular containing illustrations in colour of the various "Mazda" leaflets and showcards available, so that a choice can be made. The material offered includes revolving lamp shades, adhesive window signs, leaflets, catalogues, &c. This company also is providing posters for exhibition in all centres of the country.

A Large Russian Order.—An order for tubes which, it is stated, will keep the company's Swansea works occupied for two months, has been received from a Russian source by the British Mannesmann Tube Co., Ltd.

Victoria Falls Power Co. Employés' Demand.—The Johannesburg correspondent of *The Times* says that the employés of the Victoria Falls and Transvaal Power Company have asked the directors to arrange a conference at their earliest convenience to discuss and review the present wage rates of the operating staff. The employés point out that the company's chief customers are making large profits, and a new contract for still cheaper power has been negotiated. These circumstances, they state, justify them in expecting to share in the improved position.

The company has replied that, although the proposals appear to be out of all reason, it is willing to confer with the employés' representatives upon the matter. September 16th is suggested as a suitable date for the conference.

The German Radio Industry.—The German radio industry is stated to be passing through a serious crisis brought about by over-production and the slackness of demand. As showing the great increase in output that has taken place, it is stated that the number of German manufacturers of radio receiving sets was only 15 in December, 1923; by the end of May last there were about 200. It is anticipated that the autumn and winter months will bring about better conditions in the trade.

British Trade Mark Applications.—The following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from the dates mentioned:—

Bijouphone. Wates Bros. (lettering and design). No. 444,188. Class 8. Wireless telegraph and telephone apparatus.—Wates Bros., Ltd., 13 and 14, Great Queen Street, London, W.C.2. August 27th, 1924.

Rondar (lettering and design). No. 448,073. Class 8. Instruments and apparatus for use in wireless telephony.—A. M. Young & Co., 52, Bordesley Street, Birmingham. August 27th, 1924.

Malonite. No. 448,348. Class 8. Electrical goods, namely, dry cells and batteries (not for medical purposes).—Mather and Loft, 268, Regent Road, Salford, Manchester. August 27th, 1924.

Bestone (lettering and design). No. 439,669. Class 8. Sound-reproducing machines and components thereof.—The British Gramophone and Wireless Co., Ltd., Quality House, 22, North Audley Street, London, W.1. August 27th, 1924.

Tramway System for Rosario.—The Commercial Secretary at Buenos Aires (Mr. H. O. Chalkley, C.B.E.), has forwarded to the Department of Overseas Trade cuttings from *La Capital* of May 29th and 30th last, relative to the text of an Ordinance authorising the Municipality of Rosario to invite tenders for the construction and working of an electric tramway system in that town. Plans, conditions of tender and specifications were to be issued by the Municipality and a period of 180 days allowed for tendering. A deposit in the Banco Municipal de Prestamos of 50,000 pesos paper was required in order to qualify any tender. The opportunity to present a tender after a complete study of local conditions on the spot, which is of course essential, is only available to groups that are already conversant from experience with the conditions of operating municipal public utility enterprises in South America. United Kingdom firms desirous of receiving further particulars regarding this matter should apply to the Department of Overseas Trade, 35, Old Queen Street, S.W.1, quoting reference A.X.1274.

Lighting and Power Notes.

Barnsley.—New Mains.—The Town Council has decided to extend the mains to Stairfoot at an estimated cost of £869, and to convert six gas lamps on the route to electricity and to provide six additional lamps, at an estimated cost of £250.

Barrow-in-Furness.—Year's Working.—The accounts of the municipal electricity undertaking (engineer: Mr. H. R. Burnett) for the year ended March 31st last show a total revenue of £75,647, as compared with £75,347 in 1922. The working expenditure increased from £40,851 to £47,765, and the gross profit consequently fell from £34,496 to £27,882. Capital charges were somewhat lower, but the net profit was reduced from £8,146 to £2,195. The capital expenditure during the year was £10,276, mains accounting for £6,339. The sales of energy increased from 7,434,102 to 8,494,387 kWh, and the maximum simultaneous demand from 3,970 to 4,620 kW. The average price obtained per kWh was 2.060d., as compared with 2.318d. in 1922-23. The report states that the negotiations with Messrs. Vickers, Ltd., for the purchase of their Cavendish Park power house fell through, and plans and specifications were prepared for the installation of an additional boiler, rotary converters, and switchroom extensions, and orders were placed for these.

Betteshanger.—Overhead Power Line.—The Eastry Rural Council has granted permission to Messrs. Pearson & Dorman Long, Ltd., to erect a power line from Betteshanger to Snowdown Colliery, Nonington, provided that cradles are used for the wires crossing public roads overhead.

Belgium.—Joint Electricity Supply.—The Union des Centrales Electriques, to which twelve Belgian electricity supply undertakings are affiliated, is steadily extending its system whereby in case of breakdown or unusually heavy demand on any one plant the supply of current can be automatically taken over by the others. During the past year help in this way was given on 394 occasions, enabling the supply of power to be given without interruption to all the industrial consumers. The total amount of electricity interchanged between the affiliated concerns amounted during the twelve months to nearly 35 million kWh.

Canada.—New Plant.—With the addition of the new plant at the Northern Canada Power Company's station at Des Quinze, Quebec, it is claimed that all danger of power shortages in the mining field of Northern Ontario has been removed. The new plant installed consists of two units of 20,000 h.p. capacity and power will be transmitted to a new power station at Schumacher, a distance of 122 miles; in addition a further 25,000 h.p. will be available on October 1st.

Colwyn Bay.—Annual Report.—The net profits of the electricity department amount to £4,225. The deficit on the fund has now been cleared, and there is a surplus of £3,531.

Continental.—France.—*Extension of Area of Supply.*—La Société Electrique Lille-Roubaiz-Tourcoing is extending the area of its supply, the Tourcoing-Blanc-Four transmission line being extended to Halluins on the French-Belgian frontier. The establishment of a line between Lille and Wambrechie is also projected.

Conference.—A conference between Swiss and French authorities was recently held in Basle in connection with a scheme to utilise the water power of the River Doubs at a point on the French-Swiss frontier.

Lease of Plant.—The municipal authorities of Toulouse have leased their Ramier hydro-electric generating station to the Société Toulousaine de Bazacle. The plant, which was established in 1916, comprises six sets of turbines and generators of a total capacity of between 4,000 and 4,800 h.p. The lease is to run for a period of 39 years, the Bazacle Co. having agreed to pay an annual rent of 950,000 fr., plus certain percentages of receipts.

Overhead Lines.—The St. Remy-en-Bouzemont Syndicate of Communes has placed with the Société Energie Electrique de Meuse et Marne the contract for the erection of h.p. and l.p. lines, with transformer stations required for the projected network to serve the 38 communes which form the syndicate. To carry out this scheme the Société has just floated a bond loan of 2,900,000 fr. at 7 per cent.

Concession.—The Société Electrique de la Siderurgie Lorraine (5, Rue Jules Lefébre, Paris), has been granted a concession for the distribution of electricity for public purposes in the departments of Meurthe-et-Moselle, Meuse, and Moselle.

New Hydro-electric Station.—The hydro-electric station at Chancy-Pougny, of the Energie Electrique Rhône et Jura, is expected to start working in the course of November this year. The dam is near completion and the 120,000-V transmission line from the station to Jeanne-Rose will be ready by October. The company is applying for powers for two new branch lines to run to Sombernon and Champvert respectively, and also for a further concession to obtain power from the river Oignin, and the building of a generating station at Moux-sur-l'Ain.

Germany.—*Hydro-electric Power.*—A hydro-electric station for the supply of electricity to the town and district of Greisitz (Sagan), has recently been completed. The plant, which utilises the power of the River Bober, comprises two vertical-shaft Francis turbines built by the Fritz Neumeyer Gesellschaft, of Munich, designed to work with water at a head of only 12¼ ft. and a volume of 5,942 gal. per sec. At a speed of 68 r.p.m. the turbines and alternators are each rated at 830 h.p.

Cookstown (Co. Tyrone).—Electric Lighting Scheme.—At a public meeting in connection with Cookstown Ratepayers' Association, on the proposed lighting of the town by electricity, Mr. Ramsay, the chairman, said it was a most important matter for the ratepayers, and it was up to them to see that nothing was done to their disadvantage. From the reports in the Press of the last meeting of the Urban Council, when tenders were received for the lighting of the town by electricity, it seemed as if the matter was going to drop. Mr. H. L. Glasgow said they had got one good tender, but the matter was adjourned because the Ratepayers' Association had objected to a company's getting statutory powers. After some discussion it was decided to leave the matter in the hands of the Urban Council for the time being.

Dundee.—Plant Extension.—The Electricity Committee has decided to invite tenders for the proposed extension of the power plant at Carolina Port; the Committee has already received the sanction of the Electricity Commissioners to a loan for the purpose.

Godstone.—Electricity Supply.—The Rural Council has given permission to the Sevenoaks and District Electricity Co., Ltd., to supply electricity to premises in the area beyond the boundary of its authorised area of supply.

India.—Karachi.—The results of working of the Karachi Diesel-electric power station for the year ended March 31st, 1924, show a total of 3,275,882 kWh generated, as compared with 2,719,103 kWh in the previous year. Two new 500-kW sets were started during the period, and the consumption of oil for tuning them up and for trial runs may account for the increase from 0.66 to 0.707 lb. of oil consumed per kWh generated. The total works costs per kWh generated amounted to 0.611d., of which fuel oil accounted for 0.232d. The total cost was 1.307d. per kWh supplied to feeders. The connected load was 3,244 kW d.c. and 133 kW a.c., the maximum load being 1,072 kW and the load factor 34.8 per cent., with a diversity factor of 3.1.

Madras.—*Electricity Schemes.*—With a view to the development of electrical undertakings in the Madras Presidency and to afford assistance to local bodies which desire to undertake the installation of local electric supply schemes for lights, fans, and small power, the Government has decided to furnish professional assistance to such local bodies on lines or systems which are at present followed in connection with sanitary works, and is now prepared to consider applications from local bodies for assistance in connection with proposed local electric light and power installations. Plans and estimates for such installations will be prepared by the electrical branch of the Public Works Department, a charge being made for the services of the staff employed for the purpose. The work will be executed by the Public Works Department.—*Indian Engineering.*

(Continued on page 365).

Electricity Supply at Adelaide.

I.—The Osborne Generating Station.

By F. W. H. WHEADON, M.I.E.E., Engineer and Manager.

THE City of Adelaide (population 40,000), the capital of the State of South Australia, is the third largest of the six capital cities of the Commonwealth. It is surrounded with an extensive suburban area comprising 18 municipalities and councils forming the metropolitan area, the population of which is 279,000, and forms the principal part of the electricity supply system referred to in this article.

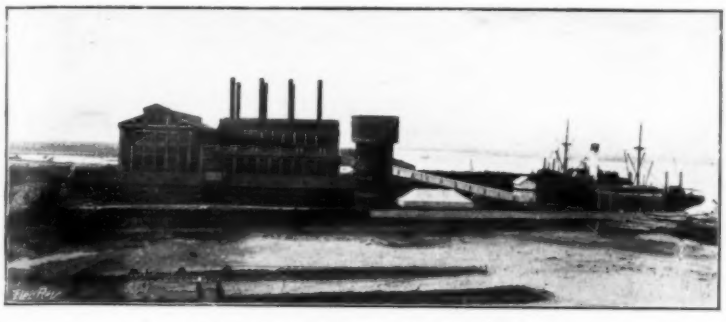

Fig. 1.—The Osborne Power Station, Adelaide.

The staple products of the State are wheat, wool, and wine; large quantities of citrus and other fruits are also grown, and in order to bring them to perfection inordinately large quantities of water are required for irrigation at certain seasons of the year. As the water has to be pumped from rivers and wells, it provides an important load, approximately 7,000 to 8,000 kW of motors for this purpose being connected. One of the most promising irrigation settlements is along the Murray River Valley. The city is not highly industrialised, and for the most part all electrical machinery, appliances, and accessories are imported, mainly from England. The use of high-voltage outdoor switchgear is, on the whole, particularly adapted to the climate. A census of the occupied houses in the Adelaide metropolitan area shows that 73 per cent. of them are connected to the Adelaide Electric Supply Co.'s system. The price of gas is from 7s. 3d. to 8s. 3d. per 1,000 cu. ft. of 500 B.th.u., and it is practically only used for cooking; none the less, the only gas company operating in the area is thriving. Electric cooking, except by means of small utensils, has not been touched; Australian conditions are in some ways not as favourable as those in England, as there is no diversity in the week-day meal hours, probably 90 per cent. of the population dining between 6 and 7 p.m. However, the company intends to make a bid for this business when the present rate of growth shows the slightest opportunity. For some years the company has maintained an annual connection of from 5,000 to 6,000 consumers to its mains. The climate, higher standard of living, and relatively low prices of energy for lighting, and a continued policy of mains extension are presumably responsible for this feature. As for public street lighting, every lamp is electric. There are 6,382 public lamps in use, but unfortunately, Australian public bodies are not as generous in street lighting as those in America or England.

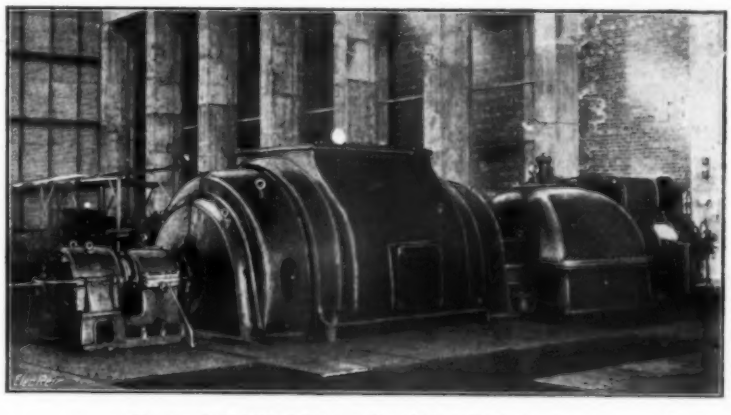

Fig. 3.—A 10,000-kW Metropolitan-Vickers Turbo-alternator.

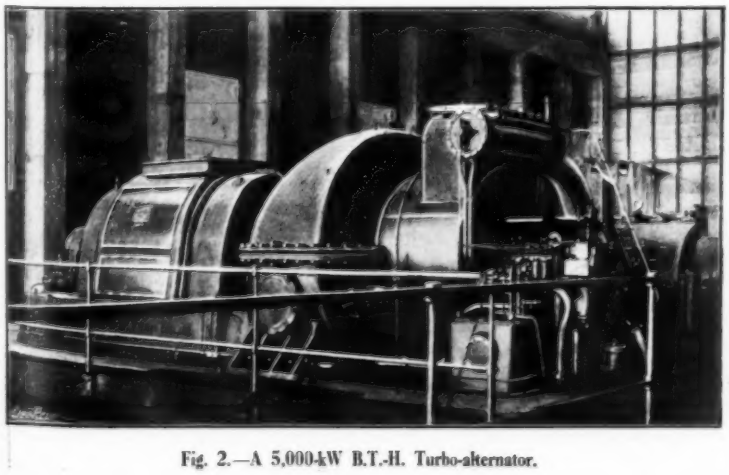

Fig. 2.—A 5,000-kW B.T.-H. Turbo-alternator.

The metropolitan area covers 155 square miles, all of which is supplied from one power house. From the English point of view, the area is sparsely settled, and undoubtedly the adoption of the Californian single-storey type of residence with a fairly large garden, makes the miles of street and distribution system unduly large for the business dealt with. To a large extent this difficulty has been surmounted by the use of overhead mains, and a standardised and economical system of construction. The greater distances and sparser population demand the use of overhead wires everywhere, except within the more important city streets.

The Adelaide Electric Supply Co., Ltd., starting in

1898 with a capital of £30,000 and a small power station at Port Adelaide, has grown to have a capital of £2,500,000 and a power station designed for an ultimate capacity of 60,000 kilowatts. Its distributing network has been laid in 650 miles of streets, and it is serving 52,000 consumers in the metropolitan area.

The company's statutory powers enable it to transmit electrical energy throughout the State of South Australia (380,000 square miles), of which only one-eighth is closely settled. The company is now extending its system to rural districts well outside the metropolitan area, and a scheme for supplying one such area, mostly agricultural, 65 miles distant, is in progress. In addition, a project for the transmission and distribution of about 10,000 kW at 110,000 V for irrigation purposes in the Murray River Valley, 155 miles from Adelaide, is under consideration.

Since 1901 the company's power station had been in the city of Adelaide, but in 1917 a 22-acre waterside site was secured at Osborne (15 miles from Adelaide), on an estuary of the sea known as the Port River, which, after reclamation and the building of a wharf, provides for the discharge of the largest colliers in the Australian coastal trade (7,000 tons) and unlimited sea water for condensing purposes. The first section, as now built, contains 30,000 kW of generating plant, and the station was first put into commercial operation in August, 1923. Since that date all the a.c. portion of the Adelaide system, about 60 per cent. of the total load, has been gradually transferred to Osborne, the only remaining load on the Adelaide station being that of the d.c. portion of the city which, for the present, is being supplied by the original d.c. generators, but will similarly be transferred to Osborne as soon as another 33,000-V transmission line and a new rotary sub-station are completed.

South Australia is the only State in the Commonwealth entirely dependent for its coal upon another State, it being all shipped from Newcastle, New South Wales, a sea carriage of 1,200 miles, which materially augments the cost and necessitates the provision at all times of reserve stocks equivalent to about six months' consumption. The coal used has an approximate calorific value of from 12,000 to 13,000 B.th.u., and its present cost is 36s. per ton delivered in 5,000-6,000-ton cargoes at the company's wharf. At present, coal is discharged from the steamers by manual labour, but it will be handled later by four 3-ton electrically-operated cranes and conveyors.

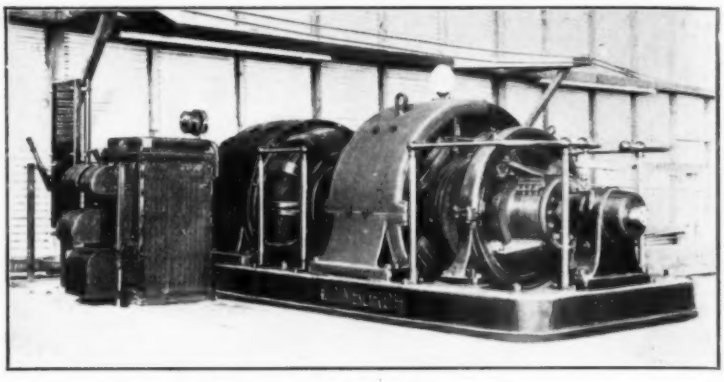

Fig. 5.—Bruce Peebles 500-kW Motor Converter.

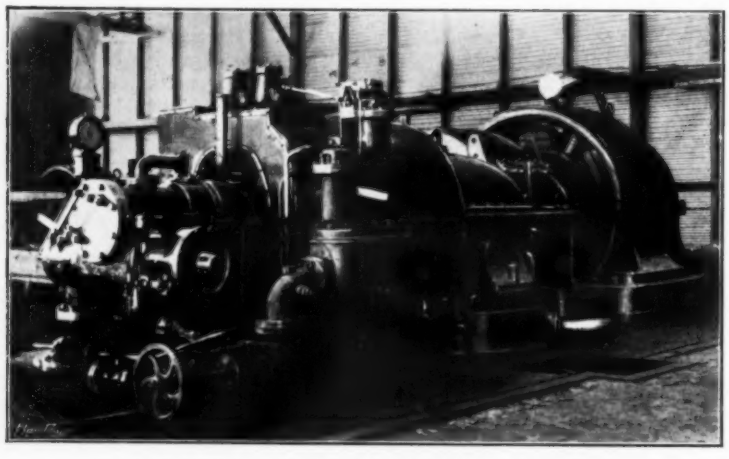

Fig. 4.—Parsons-Bruce Peebles 500-kW Geared D.C. Turbo-generator.

From a pumping chamber close to the river, sea water is pumped to the engine room through high-level ducts. The reinforced-concrete caisson, 61 ft. outside diameter by 45 ft. deep, with walls 2 ft. thick, which carries the pump-house superstructure, is believed to be the largest diameter open caisson yet built. It was built up on the ground, the weight of the shell, with a knife-edge ring at the bottom, being sufficient to cause it to sink through the sand. The enclosed soil was excavated and further sections of the wall added as the shell moved down about 8 in. daily to a depth of about 41 ft.; the bottom was then closed with a 9-ft. thick, heavily reinforced floor. Its total weight is 3,000 tons, while the upward lift, due to high tide, is about 2,500 tons;

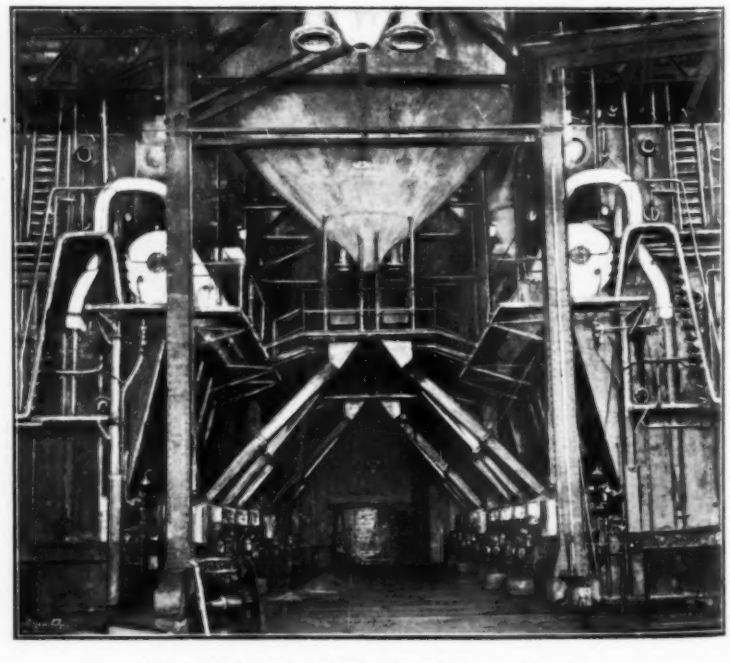

Fig. 6.—Boiler House, showing Circular Concrete Bunkers.

is was completed in a year. The velocity of water through the ducts is 5.5 ft. per minute; the reinforced-concrete pipes deal with a head of 35 ft., are 5 ft. in internal diameter. Such large Hume pipes are novel in Australia. Reinforced-concrete mats resting upon nests of piles carry the power-house superstructure of reinforced-concrete rectangular columns, the panels being filled with brick-in-cement. The pump room is circular, and has been designed for six one million gallons per hour, vertical, centrifugal pumps, there being 25.5 ft. of vertical shafting between motors and pumps, which are set out in radial formation. The installation at present comprises three motor-driven 32-in. centrifugal pumps by W. H. Allen, Sons & Co., Ltd., working against a head of 35 ft.; the motors are 250 h.p., 500 r.p.m., 440 volts, d.c. The switchgear for them and the sluice valves is remote controlled from the auxiliary switchboard in the power house. Two "Rex" rotary screens, by the Chain Belt Co., U.S.A., are installed.

In the engine room are at present installed:—One 5,000-kW (6,250-kVA), 12-stage, 3,000-r.p.m., 6,600-volt, three-phase, 50-period Metropolitan-Vickers turbo-alternator, with spring-supported surface condenser, having 10,000 sq. ft. of cooling surface with two passes for the circulating water, with an integral feed heater and Le Blanc air and condensate pumps.

One 5,000-kW, 10-stage, 3,000-r.p.m., 6,600-volt, three-phase, 50-period British Thomson-Houston turbo-alternator, with surface condenser having 9,000 sq. ft. of cooling surface and two passes for the circulating water, with kinetic rotary air and condensate pumps by W. H. Allen, Sons & Co., Ltd.

One 10,000-kW (12,500-kVA), 12-stage, 3,000-r.p.m., 6,600-volt, three-phase, 50-period Metropolitan-Vickers turbo-alternator, with spring-supported surface condenser having 20,000 sq. ft. of cooling surface and two passes for the circulating water, with integral feed heater and Le Blanc air and condensate pumps.

One 10,000-kW, 9-stage Fraser and Chalmers turbine, coupled direct to a 3,000-r.p.m., 6,600-volt, three-phase, 50-period alternator by the British General Electric Co., Ltd., with spring-supported surface condenser having 17,000 sq. ft. of cooling surface and two passes for circulating water, with Breguet "Ejectair" and condensate pumps by Messrs. Hick, Hargreaves & Co., Ltd.

The 5,000-kW B.T.-H. set was removed from the Grenfell Street station where it was originally installed in 1920.

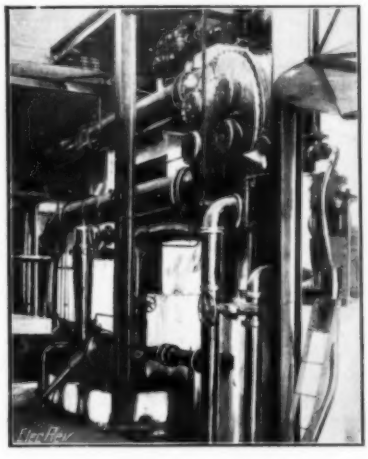

Fig. 8.—Condenser for Metropolitan-Vickers Set.

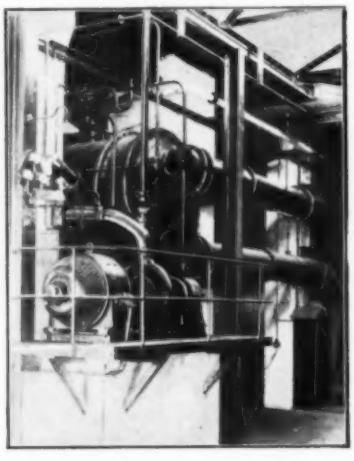

Fig. 9.—Condenser for B.T.-H. Set.

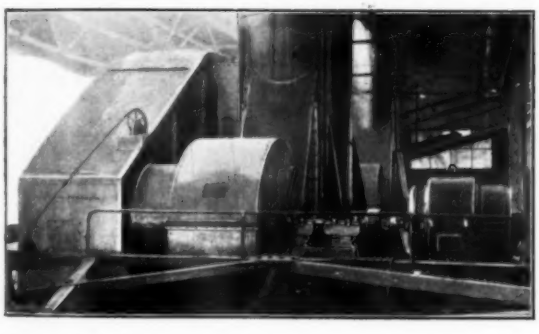

Fig. 7.—Chimney Base, showing Fan and Motor.

Communication between engine and switch control rooms is maintained by telegraph near the stop valve of each set; the turbine regulating and emergency governors are also under the control of the control-room operator. All the station auxiliaries, with the single exception of the boiler feed pumps, are electrically operated at 440 volts d.c., which is provided by a 500-kW, 6,000/750-r.p.m. Parsons geared turbo-generator. For light loads and as a spare, one 500-kW Bruce Peebles La Cour motor-converter is used, taking energy from the 33,000-volt busbars through a 33,000/7,600-volt transformer, and converting it to 440 volts d.c.

All the turbines operate with steam at 250 lb. per sq. in., superheated 200 deg. F., giving a total temperature of 606 deg. F. and a vacuum of 28½ in. The full-load steam guarantees for the 5,000-kW sets are 11.2 lb., and for the 10,000-kW sets 10.93 lb. per kWh. The air for cooling the Metropolitan-Vickers and B.T.-H. generators is passed through Sturtevant wet air

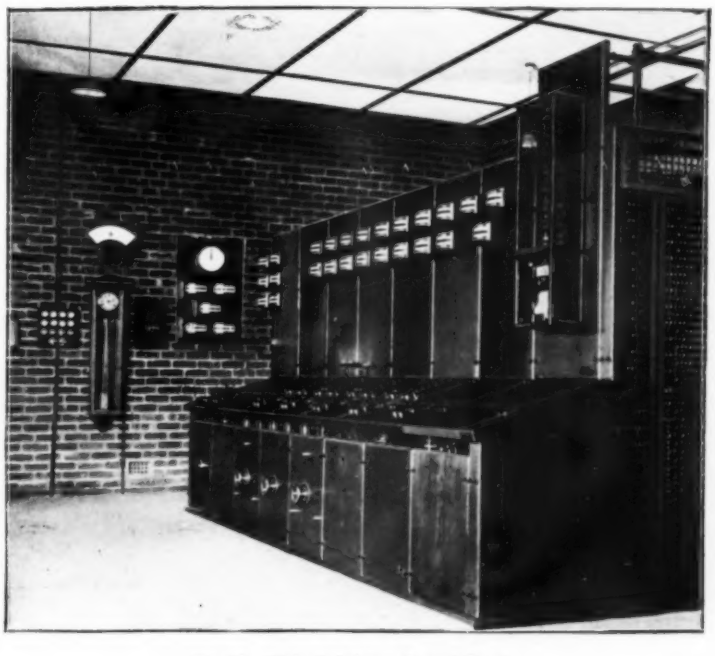

Fig. 10.—Main Switchgear Control Board.

filters placed out of doors; the G.E.C. machine has a closed air system.

In the engine room annexe are three 15,000-gallons per hour Weir turbine feed pumps, and all the feed water is distilled in Weir evaporators. With the integral feed heaters taking low-pressure steam from one of the later stages of the turbine, the condensate is raised to a temperature of from 150 to 160 deg. F., and delivered to the feed tank. Owing to the use of steel economiser tubes, it is essential that the oxygen content of the condensate shall be less than 0.5 cm^3 per litre. The condensate as delivered to the tank usually contains from 5 to 6 cm^3 per litre, but this figure is reduced to the required limit by the simple expedient of suspending a number of short ends of boiler tubes in the tank and daily cleaning off the deposit of black oxide which forms on them; the comparatively high temperature of the condensate at this point considerably hastens the action, and daily tests of oxygen content after treatment show from 0.10 to 0.20 cm^3 per litre.

The first of three similar boiler-house bays at right angles to the engine room contains eight cross-type marine Babcock & Wilcox water-tube boilers, each having 6,121 sq. ft. heating surface, 1,797 sq. ft. superheater surface, and in four of the boilers a steel superposed economiser of 4,800 sq. ft. heating surface, and in the others four similar ones, but of the Green cast-iron tri-tube type. The boilers evaporate 42,000 lb. of water per hour from and at 212 deg. F., when supplied with coal of 12,000 B.th.u., into steam at 275 lb. per sq. in. with a superheat of 200 deg. F. They are fitted with

Fig. 11.—Condenser-Water Ducts.

Babcock & Wilcox chain-grate stokers, each having an area of 231 sq. ft. The furnaces are set 4 ft. higher than the makers' usual standard, giving a furnace volume of 0.377 cu. ft. per sq. ft. of heating surface. This is higher than recent English practice, but compares very closely with the figures for large American stations. Each boiler has its own Sirocco induced-draught fan and chimney, and provision has been made for operating with balanced-draught later, or, if occasion requires, with oil fuel. The fans are electrically operated and remote controlled from the boiler-house floor. The provision of a separate fan and chimney for each boiler has given a considerable degree of flexibility of operation. Four Crosby and four Copes boiler feed-water regulators are installed.

The coal bunkers are unusual, as they are of reinforced concrete circular tank section, with coned bottoms. The capacity of each is 160 tons, and they discharge into Avery automatic weighing recorders. Coal is raised by a portable elevator from the stacking ground near the wharf, and is conveyed to the bunkers by conveyor belts provided with travelling tippers.

The ash discharges into two water-immersed cast-steel plate conveyors of the Underfeed Stoker Co.'s design, each 145 ft. in length and operated by 3-h.p. motors driving the chain at a speed of 14 ft. per minute.

The switch control room is situated at about the ultimate mid-length of the engine room. The whole of

Fig. 12.—Discharge End of Ash Conveyor.

the 33,000-volt switchgear and step-up transformers are of the outdoor type, the Osborne station being the first in Australia to adopt this particular type on a large scale. The switchboard and step-up transformers with lightning arresters for the 37,500 kVA of generating plant installed occupies a floor space of 125 by 75 ft. immediately adjacent to the control room, which overlooks the whole of the switchyard. From the switchboard bench the solenoid-operated generator and feeder main oil switches are controlled on 110-volt d.c. circuits; the operator has also complete control of the synchronising, loading, regulation, and stopping (in emergency) of the generating sets. In the basement of the building has been installed a 440-volt, 250-ampere-hour Tudor battery for operating the switch solenoids, emergency station lighting, and control circuits.

Each generator is coupled solidly to its bank of three 6,600/33,000-volt, single-phase, delta-star, step-up, water-cooled transformers, the whole being treated as a unit for switching and relay protection. The star point of each generator is brought out through current transformers and solidly grounded, as is also the neutral of the 33,000-volt star side of the step-up transformer. Duplicate 33,000-volt busbars, carried on insulators supported on a pipework frame structure, are provided with double-throw selector switches. The outdoor

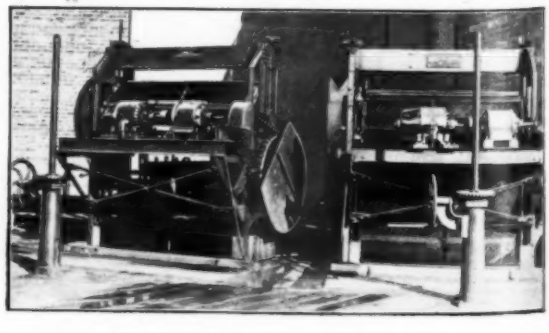

Fig. 13.—"Rex" Condenser-Water Screens.

generator and feeder oil switches are all of uniform type and size, being the American General Electric Co.'s FKO-36-8b solenoid-operated type, having a current-carrying capacity of 400 amperes and a rupturing

capacity of 250,000 kVA. They are fitted with bushing-type current transformers for operating the ammeters and protective relays. The generator oil switches have contact-closing studs which close the relay circuit of solenoid-operated field switches and trip the emergency governor when automatically tripped by a fault in the generator, or secondary side of step-up transformers. For lightning protection two banks of three-phase outdoor oxide film arresters are used at the power station end of the two overhead transmission lines. In order to avoid switching complication, the usual 6,600-volt busbars have been omitted and all supplies, both for local and distant requirements, are taken from the 33,000-volt bars. The generator cables are concentric, lead covered, and laid in ducts, while the control cables are v.i.r., lead covered, multicore.

The Osborne station has been in operation less than twelve months, and only a portion of the company's system has been transferred to it from the Grenfell Street station, but during the last three months the following results have been typical:—

Water per kWh generated	14.50
Coal per kWh generated	1.70
Boiler-house efficiency	76.00
Station thermal efficiency	14.30
Load factor (3 months' basis)	50.75
Station plant factor	52.00
Maximum load, kW	9,000

The design of the layout and the erection of the whole Osborne plant was carried out by the company's engineering staff, while the following is the relative cost of the major items of the 30,000 kW of plant installed:—

*Land and wharf	5.56%
Buildings and piling	28.80%
Boilers and steam pipes	26.40%
Generating plant	22.42%
*Circulating-water system	5.47%
Switchgear, transformers, batteries, &c. ...	5.24%
*Coal-handling gear, conveyors, &c.	4.70%
Sundries	1.41%
	100.00%

*These items provide for a maximum demand of 60,000 kW, others for 30,000 kW.

(To be concluded.)

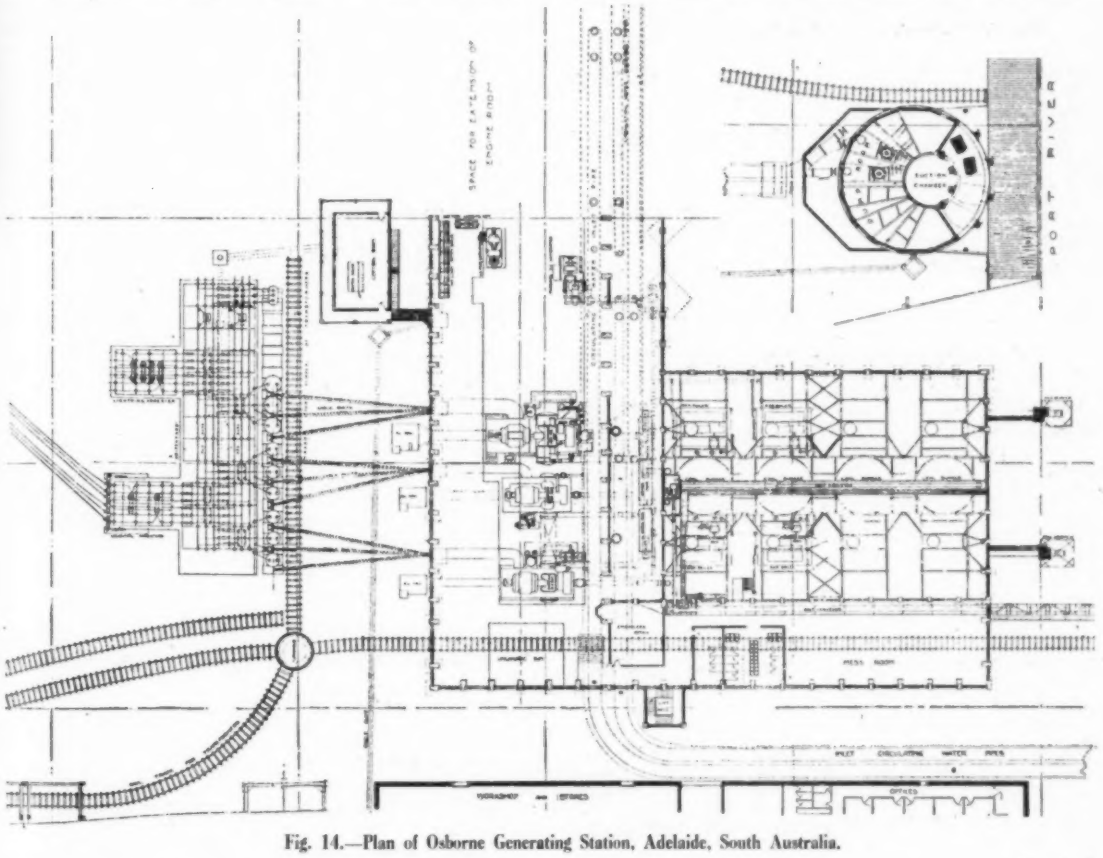

Fig. 14.—Plan of Osborne Generating Station, Adelaide, South Australia.

Lighting and Power Notes.

(Continued from page 360.)

Irish Free State.—KINGSTOWN (CO. DUBLIN).—*Electricity Scheme.*—At a meeting of the Urban Council, on the adoption of a report from the Electricity Committee, the Chairman expressed gratification at the large number of residents who had had their homes wired for electric lighting. This, he said, augured well for the success of the new township undertaking.

Linlithgow.—STREET LIGHTING.—The laying of the distributing cables throughout the town is almost completed and it is expected that the electric lighting will be inaugurated about the beginning of October.

Leatherhead.—SPECIAL ORDER.—The Minister of Transport is recommended to confirm the Special Order authorising the Leatherhead and District Electricity Co., Ltd., to supply electricity within the parishes of East and West Horsley and East Clandon and part of the parish of Chessington.

Maidstone.—ANNUAL REPORT.—The accounts of the Corporation electricity undertaking for the year ended March 31st last shows total revenue £79,235, as compared with £76,223 in the preceding year, expenditure £51,294 as against £46,262, repayments and interest on loans £19,292 as against £18,751, and net profit £8,425 as against £10,602 for 1922-23. The amount of electricity sold increased from 10,442,858 to 11,293,939 kWh, and the maximum demand rose from 3,510 to 4,070 kW.

Preesall.—POWER STATION SITE.—The Urban District Council has appointed a small sub-committee to choose a suitable site for a power station.

Preston.—NEW STATION.—Mr. J. F. Simpson, chief electrical engineer, reports that although the six weeks' building strike had hindered the erection of the new electric power station, it was hoped to get some of the plant into operation by the end of October. It was probable that in time the docks would be illuminated by electricity. The two main transforming stations would be at Messrs. Dick, Kerr's works and Crown Street station, while 20 or 30 smaller stations would be established in different parts of the town. The station could easily be enlarged, and another turbine could be placed in the existing building when necessary.

Redcar.—INAUGURATION OF SCHEME.—On Monday last the electricity scheme, carried out chiefly by unemployed labour, was put into operation by the Mayoress. The work of cable laying began last Easter. At first it was intended to limit the area of supply to the centre of the borough, but sanction was obtained to extend the scheme so as to embrace the whole town, with the promise of the Government unemployment grant of 50 per cent. of interest charges for 15 years on the

cost of the entire undertaking. Coun. O'Brien, at his own expense, prepared the scheme, and supervised the organisation. Supply will be received in bulk from the Cleveland & Durham Electric Power Co., at a pressure of 11,000 V, which for distribution will be stepped down to 400 V (three phase) for power purposes, and 250 V (single phase) for lighting. The system of distribution is a ring main system with interconnections. It is not at present intended to supplant gas lighting in the streets by electricity, but it is expected that eventually this change will be made, and provision has been made for this in laying the cable. Two sub-stations have been built. One is at Wiley Brig, Dormanstown, and the other at Milbank Terrace.

Rhuddlan (North Wales).—ELECTRICITY SUPPLY.—The Council has decided to take a supply of electricity from the Gwenneth Trust in connection with the Dolgarrog scheme, at 6d. per kWh for public lighting or £3 per lamp per annum; for private consumers 9d. per kWh for lighting, and for power 4d. per kWh.

Southend-on-Sea. — HYDRO-ELECTRIC POWER. — The Light Railways and Electric Lighting Committee has adjourned consideration of the offer to supply 10 million kWh of electricity under the Mersea Hydro-electric Scheme, until the first ordinary meeting in September, and has invited Mr. L. Weaver to attend.

Stirling.—YEAR'S WORKING.—The accounts of the burgh electricity undertaking (engineer, Mr. W. R. Murray), for the year ended May 15th last, record a total income of £14,280, as compared with £15,159. The working expenses amounted to £8,984, as against £10,599, leaving a gross surplus of £5,296 (£4,559). After the payment of capital charges, &c., there remained a net profit of £473, which was carried to reserve; the previous year's profit was £568. The energy sold increased from 813,911 to 920,798 kWh, and the maximum demand from 528 to 600 kW.

Thirsk. — PUBLIC LIGHTING. — The Parish Council has accepted the tender of the Northern Counties Electric Supply Co. for the general lighting of the parish and improved lighting of the Market Place.

Thornton-le-Fylde.—ELECTRICITY SUPPLY.—The U.D.C. has decided to communicate to the Electricity Commissioners the terms upon which it would be prepared to take a supply of electricity from Blackpool Corporation.

Windsor.—ELECTRICITY ORDER.—The Electricity Commissioners have informed the Rural Council that the order reorganising the supply of electricity in the London and Home Counties Electricity District includes the parish of Old Windsor in the borough of Windsor and the rural districts.

Tramway and Railway Notes.

Aberdeen.—NEW TRAMCARS, &c.—The Tramways Committee has recommended that 20 cars be reconditioned, at a cost of £21,000, and the Tramways Manager has been instructed to invite estimates for ten additional cars.

Ashover.—LIGHT RAILWAYS EXTENSION.—The Minister of Transport has made an order (Ashover Light Railway (Extension) Order, 1924) authorising the construction of light railways in the parish of Ashover, in the rural district of Chesterfield, in extension of the light railways authorised by the Ashover Light Railway Orders, 1919 and 1923.

Blackpool.—YEAR'S WORKING.—We have received a copy of the report of the general manager (Mr. Charles Furness) for the year ended March 31st last, together with the accounts of the Corporation tramway undertaking. The total revenue from all sources amounted to £273,657, and the working expenditure to £184,021, leaving a gross balance of £89,636. These figures were similar to those of the previous year, which were:—Revenue, £270,241; expenditure, £178,242; gross profit, £91,999. From the surplus a deficiency of £212 on the omnibus account was deducted, and to it was added bank interest of £3,483, making £92,907 available. Capital charges, &c., absorbed £39,814, and the net result was thus a profit of £53,093, as compared with £34,381 in 1922-23. This was added to £34,524 from the last account, making £87,617. Sinking fund contributions amounted to £18,296; £10,000 was devoted to rate relief; £15,700 was transferred to reserve funds; and a balance of £43,621 remained for further disposal. The capital account shows a total expenditure of £740,450, of which £70,338 was incurred during the year, principally in the reconstruction of the permanent way. The car-mileage increased from 2,465,440 to 2,605,269, and the number of passengers carried from 34,824,693 to 37,981,507.

Fleetwood.—PLANT BREAKDOWN.—Owing to the bursting of a boiler at the electricity works last week the town supply of electricity was cut off for some time, and the tramcar service was held up. Eventually a supply was obtained from Blackpool.

Huddersfield. — TRACK RECONSTRUCTION. — The Tramways Committee has decided to proceed immediately with the reconstruction of the track in Manchester Road (Chapel Hill to Longroyd Bridge).

Llandudno.—ELECTRIC MOTORS.—The Great Orme Railway Co. is considering substituting electric motors in place of steam power on its system, and has asked the Llandudno Town Council if it proposes to exercise the compulsory powers of purchase of the company's undertaking in 1926.

London.—TRAFFIC CONTROL.—The first order under the London Traffic Act, which was passed at the end of last month, was issued by the Minister of Transport, Mr. H. Gosling, on August 28th, fixing September 1st as the date for the appointment of the Traffic Advisory Committee, set up by the Act, and October 1st for the remaining provisions to come into operation.

Maidstone. — ANNUAL ACCOUNTS. — The report of the Council's tramway undertaking for the year ended March 31st last show a revenue of £24,065, as compared with £25,017 (there was a reduction of fares last year), expenditure £16,029, as against £17,084, repayments of principal and interest £4,333 (£4,556), and net profit £3,816, as compared with £3,490 in 1922-23. The total number of passengers carried was 3,646,189, as compared with 3,582,166.

Manchester.—PROPOSED FARE REDUCTION.—The Tramways Committee has decided to postpone for three months the proposal to increase the length of the penny stage on the Corporation tramways by 600 yards, making the distance a mile and a half, as during this period the Committee expects to receive the Wages Tribunal's reply to the men's application for an advance of wages. The proposal for contract tickets has been rejected.

The borough surveyor recently reported that the facilities afforded by the five electric vehicles used for the collection of house refuse had enabled an additional quantity at the rate of approximately 10 tons per day to be collected with the existing staff. He was authorised to obtain quotations for the purchase of an additional vehicle and to submit them to the Committee at the next meeting in September.

Sunderland. — WAGES DEMAND. — The tramwaymen have voted in favour of immediate action to enforce their demand for an advance of 2s. per week to bring them up to the national wages scale. Before action is taken another effort is to be made to settle the dispute with the Corporation Tramways Committee.

Swansea.—MUMBLES RAILWAY ELECTRIFICATION PROPOSAL.—An application to the Ministry of Transport under the Railways (Electrical Power) Act, 1903, is being made in respect of the "Oystermouth Railway and Tramroad and Mumbles Railway" by the Swansea Improvements and Tramways Co., which is working the railway by steam under a lease.

Telegraph and Telephone Notes.

Atlantic Cables.—GERMAN NEGOTIATIONS.—The German Atlantic Telegraph Co. is, according to the *Financial Times*, at present negotiating with foreign interests, but it is stated that care will be taken to preserve the German character of the undertaking.

Hungary.—TELEGRAPH ADDRESSES.—It is proposed to make a telephone number and a name sufficient address for telegrams to be delivered in any city in the country.—*Daily Mail.*

Jugo-Slavia.—ITALIAN AGREEMENT.—An agreement has been come to between the Italian and Jugo-Slavian Governments concerning their respective telephone and telegraph services. Both parties pledge themselves to preserve intact all existing lines, whether working or otherwise. The telegraph lines from Fiume to Zagabria and Fiume to Geni, as well as the Fiume to Belgrade line, will be brought into a working condition. The internal tariff will be used at all telegraph stations communicating with Zara and its neighbourhood. The undersea cable communicating with Pola and Sebenico will be taken up, and the plant used to unite Spalato with an Italian port. There will be set up a telephone line from Lubiana to Zagabria and Belgrade, on one side, and from Udine to Gorizia and Trieste on the other. Italy, furthermore, pledges herself to construct a direct telephone line from Milan to Serboslavia.

Spain.—TELEPHONE SERVICE.—A decree was published on August 28th in Madrid assigning to the National Telephone Co. the control of all the telephone services throughout Spain. —*Reuter.*

According to the *Evening News*, the company has been formed with Spanish capital, and employs United States experts of the International Telephone & Telegraph Corporation. Big extensions of internal and external means of communication are planned. The concession is for a number of years.

United States.—ITALY SERVICE.—The shore end of the new Western Union cable was, according to the *Financial News*, to be completed on September 2nd and will thus establish for the first time direct communication between America and Italy.

Radio Notes.

Australia.—BROADCASTING IN SCHOOLS.—The Minister for Education (Mr. Bruntnell) has decided to permit the installation of radio receiving sets in schools by Parents and Citizens' Associations, on the understanding that the local bodies bore the cost and installed only receiving instruments approved by the department as suitable for school use. He considered the scheme would bring isolated country centres into contact with Sydney, and the use of the schools as social centres in the evening during the transmission period should do much to remove the isolation of communities; he added that it was not expected that wireless would be used for regular instruction. At the same time supplementary matter of general educational value could be provided. An advisory committee appointed by Mr. Bruntnell is inquiring as to the type of set which should be installed in the schools. —*Sun.*

Cardiff.—A GARDEN PARTY.—The Cardiff broadcasting station (5 WA) is giving a garden party to its hitherto invisible audience on September 13th in the Sophia Gardens. The whole programme for the day will be given in the open air, instead of in the usual studio, and the public will have an opportunity of watching actual broadcasting in progress. The entire profits from the party, which has been organised in conjunction with the Cardiff and South Wales Wireless Society, are to be devoted to the Cardiff Royal Infirmary for the furtherance of the violet-ray treatment.

France.—EIFFEL TOWER STATION.—The Eiffel Tower is no longer to be used for disseminating entertainments. In future the Eiffel Tower will only be used for broadcasting official statements and propaganda intended primarily for foreign ears. It will, in short, be a Government service.—*Daily Telegraph.*

Northern Ireland.—NEW BROADCASTING STATION.—By the end of the year the B.B.C. hopes to have a total of 19 broadcasting stations in commission; nine will be main and 10 relay stations, apart from the high-power, long-wave, station at Chelmsford, the future of which is still under consideration by the P.O. authorities. Meanwhile permission has been given for 5 XX to remain in action; it has been mainly experimental, and has afforded useful data. The new main station at Belfast will begin sending out programmes on September 15th, but the official opening will not take place until October. Some difficulties have been experienced in connecting Belfast with English stations. The ordinary land-lines have had to be substituted in part by an undersea cable, in which respect the station is unique. Suggested alterations by the B.B.C. are being made by the Post Office to the cable, and preliminary tests have proved satisfactory.

Sweden.—NEW BROADCASTING STATIONS.—Tenders for the construction and fitting of five broadcasting stations at Stockholm, Gothenburg, Malmoe, Sundsvall, and Boden will be invited by Telegrafstyrelsen (Telegraph Board) in the immediate future.—*Reuter's Trade Service* (Stockholm).

Contracts Open and Closed.

(The date given in parentheses at the end of the paragraph indicates the issue of the ELECTRICAL REVIEW *in which the "Official Notice" appeared in our advertisement pages.)*

Open.

Argentina.—BUENOS AIRES.—October 27th. Ministry of Public Works. 25 steam travelling cranes and 1 stationary electric crane.*

Australia.—MELBOURNE.—December 1st. State Electricity Commission. 66,000-V transformers, induction regulators and accessories for the Yallourn power scheme. (See this issue.)

SYDNEY.—October 29th. N.S. Wales Government Railways and Tramways. Two electric storage batteries for signal operating, and two battery-charging motor generators.*

Belfast.—September 8th. Electricity Department. One electrically-driven passenger lift. Specifications from Mr. Johnstone Wright, city electrical engineer.

Belgium.—GHENT.—October 4th. Burgomaster. Three electric portal cranes.*.

September 17th. La Compagnie Intercommunale d'Electricité de Jodoigne et Extensions, 19, Rue de Pietrain, Jodoigne. Installation of the plant for the supply of electrical energy to the commune of Chaumont-Jistoux. Plans and specifications for 30 fr.

Birkenhead.—September 18th. Mersey Railway Co. Stores including electrical sundries, metallic and carbon filament lamps. Secretary, Central Station, Birkenhead.

Bolton.—September 6th. Board of Guardians. Electric lighting installations at Fishpool Institution, the Hollins Cottage Homes, and the Townleys House, Farnworth. Specifications from Mr. John Ward, architect to Board of Guardians, 24, Mawdsley Street, Bolton.

Bridlington.—September 17th. Electricity Department. Coal (washed smalls) for six or twelve months in approximate quantities of 2,500 or 5,000 tons. Borough Electrical Engineer, Electricity Works, Brett Street.

Canada.—TORONTO.—September 16th. City Council. One 40 million-gallon centrifugal pump and electric motor, or two 20 million-gallon pumps and motors.*

WINNIPEG.—Manitoba Power Commission. Six small water wheels.*

Corfu.—September 28th. Port Authorities. Installation of electric lighting plant at the Port, or, alternatively, for the supply of electricity, including the laying of mains, &c. Particulars from M. le Vice-President de la Commission, Executive du Port, Corfu.—*Reuter's Trade Service.*

Czecho-Slovakia.—PRAGUE.—October 21st. State Railways. Electric locomotives and materials in connection with the electrification scheme. (Ref. A X 1,261.)*

Darlington.—September 16th. Electric lighting installation at Eggleston Church. Mr. J. W. Stokoe, hon. secretary.

Dundee.—September 8th. Water Commissioners. Rewiring offices at 93 and 95, Commercial Street. Specification, &c., from Mr. George Baxter, Junr., engineer and manager.

September 18th. Electricity Supply Department. Extensions to engine room and switch-house, Carolina Port generating station, and at Lawton static sub-station; 60-ton overhead electric travelling crane for Carolina Port generating station. Mr. D. H. Bishop, B.Sc., general manager and engineer.

September 18th. Electricity Department. Arc lamp carbons. (See this issue.)

Edinburgh.—September 8th. Electrically-driven pumps, with switchgear, &c., and an electric locomotive grab crane, &c. (August 22nd.)

Egypt.—CAIRO.—October 1st. Egyptian State Railways. 500 wall telephones. Specification from the Stores Department, Saptia (Cairo), or Gabbary (Alexandria). Simultaneous offers will be received at the Inspecting Engineer's office in London.

Egyptian State Railways and Telephones. Unarmoured cable. (See this issue.)

Faversham.—September 6th. Electricity Department. Water cooling tower, motor-driven centrifugal pumps, and centrifugal oil purifier. (August 22nd.)

September 15th. Electricity Department. Various lengths of l.p. paper-insulated, lead-sheathed armoured cable. (See this issue.)

Glasgow.—Corporation. Re-wiring the whole electrical installation at Govan Town Hall with steel tubing and alternatively re-wiring portions of the installation. City Engineer.

London.—HOLBORN.—September 10th. Board of Guardians. Six months' supply of electrical fittings, &c. Mr. C. J. Cross, clerk to the Guardians, 53, Clerkenwell Road, E.C.

BERMONDSEY.—September 18th. Board of Guardians. Electric lamps required during six months. Mr. H. E. Reeve, clerk to Guardians, 283, Tooley Street, London, S.E.1.

ISLINGTON.—September 9th. St. Mary Board of Guardians. Electrical supplies during the six months commencing October 1st. Mr. A. King, clerk to the Guardians, 6, St. John's Road, Upper Holloway, London, N.19.

ISLINGTON.—October 17th. Electricity Department. Water tube boiler, with oil fuel installation, draught system, flues, steam piping, &c., and dismantling and removal of four water-tube boilers. (See this issue.)

H.M. OFFICE OF WORKS. September 19th. Electric wire and cable. (See this issue.)

SOUTHWARK.—October 1st. Electricity Department. Cables for 12 months. (See this issue.)

New Zealand.—NEW PLYMOUTH.—October 22nd. Harbour Board. Three electric capstans, &c.*

Salford.—September 11th. Education Committee. Electric light installations. Particulars from Mr. R. S. Martin, Secretary to the Education Committee, Education Offices, Chapel Street.

September 8th. Electricity Committee. Electric lighting installation, Agecroft Power Station. Mr. J. A. Robertson, consulting engineer, Brazennose House, 20, Brazennose Street, Manchester.

Switzerland.—September 27th. The Swiss State Railway authorities in Berne. Installation at the Vernayoz power station of three 11,000 kVA, 15,000/66,000 V single-phase alternators; three 15,000/132,000 V single-phase transformers, and the necessary switchgear, measuring and recording instruments. Particulars for 10 fr. from the Abtheilung für Elektrifizierung, Dienstgebaude, Bureau 164, 43, Mittelstrasse, Berne.

Turkey. — CONSTANTINOPLE. — October 2nd-November 9th. Posts & Telegraphs Department. 4,500 kilos bronze wire.*

Warrington.—September 16th. Electricity and Tramways Committee. H. and l.p. paper and lead-covered cable. (See this issue.)

West Ham.—September 8th. Tramways Department. Six double-deck electric tramcar bodies, with totally-enclosed roof covers; 6 car sets of centre-bearing swing bolster trucks. Mr. L. Slattery, general manager, Greengate Street, Plaistow, E.13.

September 20th. Electricity Department. One 10,000-kW turbo-alternator, one 10,000-kW surface condensing plant, three water-tube boilers, superheaters, &c., or, alternatively, a complete scheme, including alternator, condensing plant, water tube boilers, &c., with other auxiliary plant, pipework, &c. (See this issue.)

Workington.—September 13th. Corporation. H.p. and l.p. cable, h.p. and l.p. switchgear, including erection, and a 100-kVA transformer. (August 29th.)

*Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Closed.

Belfast. — Tramway Reconstruction Contract. — With further reference to the note on page 331 in last week's Elec. Rev., the City Council, at a special meeting last week, after long discussion, decided to accept the tender of Messrs. McKee & Son, Ltd., for £187,949.

Brighouse.—Electricity Committee. Accepted:—
Cable (£3,405).—W. T. Glover & Co., Ltd.

Castlewellan (Co. Down).—Accepted:—
Electric lighting installation at Castlewellan Castle for Lady Annesley.—Coates & Son.

China. — Mukden. — Peking-Mukden Railway (Mukden-Shanhaikuan Section). Accepted:—

	Mex. dollars.
Two electric pneumatic power hammers, B. S. Massey... ...	9,100
One portable electric welding plant, Metropolitan-Vickers Electrical Co., Ltd.	1,760
One centrifugal motor-driven fan, Blackman Export Co. & Metropolitan-Vickers Electrical Co., Ltd.	1,360
One 110-kW steam d.c. set, Belliss & Morcom and Crompton and Co.	9,465
One 30 h.p. d.c. motor, English Electric Co., Ltd.	1,600
One main d.c. switchboard, English Electric Co., Ltd.	2,300
One 30 h.p. a.c. motor, two 10 h.p. do., three starters and switches, English Electric Co., Ltd.	3,113

Derby.—London, Midland & Scottish Railway. Accepted:—
5,000 special train lighting lamps.—General Electric Co., Ltd.

Enniscorthy (Wexford).—Urban Council. Accepted:—
Erection of a power station in connection with the electric lighting scheme (£1,395).—Bernard Maguire.

Glasgow.—Health Committee. Recommended:—
Electrical installation at the Bridgeton Child Welfare Centre (£119).—J. B. and J. A. Mathieson, Ltd.

Tramway Committee. Accepted:—
Trolley bushes.—Kay & Co. and Messrs. Birkbys, Ltd.
Manganese steel tramway rails.—Edgar, Allen & Co., Ltd.

Kent.—Snowdown Colliery. Accepted:—
Electrically-driven winder.—English Electric Co., Ltd.

Mutford and Lothingland.—Board of Guardians. Accepted:—
Installation of electric lighting at the workhouse and infirmary (£915).—C. C. Pudney & Co.

Newtown (Mon.).—Town Council. Accepted:—
Ash-handling plant (£5,444).—Babcock & Wilcox, Ltd.
Circulating pump and control gear.—Sulzer Bros.

Oswaldtwistle.—Urban District Council. Accepted:—
Electric lighting installation of Town Hall offices.—W. Lofthouse.

Salford.—Finance Committee. Accepted:—
Maintenance of the intercommunication telephone system at the Town Hall and the Education Offices for five years (£164).—E. M. Evans and Son, Ltd.

Tramways Committee. Accepted:—
Special tramway track work (£3,902).—Hadfields, Ltd.
Two tramcar motors (£504).—English Electric Co., Ltd.

Electricity Committee.
H.p. and l.p. cable (£1,067).—W. T. Glover & Co., Ltd.
Coal for the electricity station: 6,000 tons Clifton Hall washed peas, 25s. per ton, A. Knowles & Sons, Ltd.; 4,000 tons No. 2 washed slack at 25s. per ton, Clifton & Kersley Coal Co., Ltd.; 2,000 tons No. 1 washed slack at 21s. 6d. per ton, Bridgwater Wharves, Ltd. Total amount, £14,750.

South Africa.—Cape Town.—Electrification of Suburban Railways.
Three 10,000-kW turbo-alternators.—Jas. Howden & Co., Ltd.
Three surface condensers complete with auxiliaries, each condenser to deal with 104,000 lb. of steam per hour.—Mirrlees Watson Co., Ltd.
The daily Press states that the values of the contracts are £80,000 and £20,000, respectively.

Wembley.—British Empire Exhibition.
Electric lamps for illuminating the N.W. Garden of the Exhibition.—Siemens & English Electric Lamp Co., Ltd.

Forthcoming Events.

Institute of Metals.—Annual Autumn Meeting.—At the Institution of Mechanical Engineers, Storey's Gate, S.W. Monday, September 8th, at 8 p.m.; Tuesday and Wednesday, September 9th and 10th, at 10 a.m.

Institute of Marine Engineers.—Tuesday, September 9th. At the Institute, the Minories, E. At 6.30 p.m. Paper on the "Measurement of Pressure," by Mr. J. L. Hodgson.

The "Electrical Review" Service Department.

Inquiries must be accompanied by a stamped addressed envelope.

We should be glad to know the names of makers or suppliers of:—
Fine steel pivots for instruments.
A platinum substitute for contacts at a much lower price.
The smallest possible tumbler switches (safe up to 250 volts).
The Elieson all china switch.
Machines for filling loose carbon into pocket batteries.
Also a firm undertaking electric arc cutting under water.

Notes.

Report on Euston Railway Accident.—The collision between two passenger trains near Euston (L.M.S. Railway) Station on April 26th forms the subject of a report to the Ministry of Transport by Col. J. W. Pringle. The trains involved were a steam-engine drawn excursion train and an electric train; five passengers were killed, and 68 passengers and the two guards were injured. From the evidence it appears that the occurrence was due to a mistake of an experienced signalman who "cleared" the excursion train on the wrong line and allowed the electric train to follow it up and collide with it in the rear. The driver of the electric train was held to be blameless owing to the conditions in the tunnel in which the accident occurred. The inspector considers that track-circuiting would have probably averted the accident, and recommends its adoption on this line. Col. Pringle further states:—

"Although, fortunately, there was no ill result from the use of gas as an illuminant, the case furnishes no argument for departure from the view so often expressed by inspecting officers in previous reports, which is now supported by an actual reference in Requirements, that there is danger in the use of gas as an illuminant in the event of accident. The risk is greater in such an enclosed space as a covered way or tunnel. A recent illustration of the danger from the use of gas for illuminating railway carriages is the case of the disaster at Bellinzona on the Swiss Federal Railways. It is satisfactory, therefore, to hear that the policy of the company as a whole is in the desired direction, *i.e.*, the adoption of electricity in place of gas in the case of all new stock. It is hoped that the proportion of electrically-lighted stock will in the future rapidly increase." He also says:—

"It is desirable that motormen, conductors or guards of electric trains should be more practically instructed in the use of the short-circuiting bar, not only in respect of emergencies calling for the use of the bar when the rails are dead, but also in their use on live conductors, so that they may be accustomed to handle them when emergency arises with a greater sense of security."

Electric Vehicles in France.—So far sixteen vehicles have been entered by seven makers for the trials of electric vehicles to be held in France during the latter half of the present month under the auspices of the Union des Syndicats de l'Electricité.

An association of French builders of electric vehicles has recently been formed in Paris (25, Boulevard Malesherbes), with the title Union du Syndicat de Constructeurs de Véhicules Electriques.

Electricity for Dispersing Fog.—New experimental equipment produced at the Cruft laboratories of Harvard University is being installed in a large De Haviland plane for the purpose of dispersing fog or clouds. This includes sand boxes on each side of the fuselage, which are connected to batteries. By pulling a lever the electrified sand is released through a nozzle and sprayed over the cloud or fog bank which is to be exterminated.—*Science.*

Social Event.—On Saturday last the annual horticultural exhibition and garden party of the County of London Electric Supply Co., Ltd., Social Society, was held at Thornton House, Clapham Park, and was attended by a large number of members and their friends. In spite of threats, the weather proved fairly favourable, and the proceedings were very successful; the exhibits of fruit and flowers were remarkably meritorious and numerous, and the programme included sports, guessing competitions, music, and dancing, as well as tea to the strains of the Welsh Choir by radio from Wembley.

Suggested Import Duty on Electricity.—In view of the increasing quantity of electrical energy which is being "exported" from Swiss generating stations to consumers in France, it was recently proposed that the French Government should impose a duty on imported current. The Syndicat Professionel des Producteurs et Distributeurs d'Energie Electrique reports that after consultation with the Chambre Syndicale des Forces Hydrauliques it is at present not disposed to support the proposal partly because a uniform rate of duty might cause serious inconvenience in certain cases, and partly because the amount of duty proposed in the majority of cases would be insufficient to afford those interested sufficient protection.

An Electrical Carnival and Dance at Wembley.—Wednesday, September 17th, should be regarded by all electrical men as the day of days on which to visit the British Empire Exhibition and to take an active part in the Electrical Carnival and Dance which is being organised by the exhibitors in the Electrical Section of the Palace of Engineering.

To open the evening's entertainment, a procession of gaily-decorated electric vehicles and fancy-dress models of electrical appliances will start from the Faraday Gate of the Palace of Engineering, and will wend its way round the Exhibition until it arrives at the Great Palace of Dancing in the Amusements Park.

Dancing will commence about 8 o'clock, to the strains of the British Empire Exhibition Dance Band, which has been specially engaged for the purpose.

Visitors in fancy dress representing some electrical device or symbol will be specially welcomed, and it is hoped that such visitors will take part in the procession.

Special competitions will be held during the evening, for the best fox-trotting couple and the best fancy costume. Other special contests will be held, and valuable prizes will be presented to the winners.

Everyone connected with the electrical industry in any capacity, together with relatives and friends, is cordially invited to take an active part in the proceedings, and in view of the fact that this is the one occasion during the whole of the Exhibition when a special electrical night of this character is possible, it is confidently expected that the attendance of electrical visitors will be a record one.

Tickets, price 6s. each, which includes admission to the Dance Hall, and refreshments during the evening, can be obtained on application to:—Mr. Gillott, E.D.A., Avenue 13, Bay 1, Palace of Engineering, Wembley; The ELECTRICAL REVIEW, 4, Ludgate Hill, E.C.4, or Mr. Gibson Young, B.E.A.M.A., Avenue 15, Bay 8, Palace of Engineering, Wembley.

Early application for tickets is particularly desirable.

Those responsible for the organisation have already received promises of whole-hearted support from the majority of the firms exhibiting in the electrical section, and many of them have undertaken to arrange that members of their staff shall represent them in fancy dress in the procession.

To any firms which have still held aloof, a special appeal is made to assist in every way to make a complete success of a function which, so far as the procession is concerned, will undoubtedly be regarded as representative of the industry in its various functions of supply, manufacturing, and contracting, by the large crowds that are expected during the carnival period. Obviously the value of a direct appeal in this fashion to many thousands of people cannot be over-estimated.

The members of the Incorporated Municipal Electrical Association will be at Wembley in considerable force on the carnival day, and will no doubt add to the numbers taking part in the festivities.

By those intending to take part it should be specially noted that evening dress is optional, since many who have been at Wembley all day will have little opportunity or desire to change into the costume of convention.

American Electric Vehicle Exports.—There was a marked falling off in the exports of electrical vehicles from the United States during the twelve months ended with June last, returns just to hand showing a total of only 92 vehicles, valued at $128,530 as compared with 279 and $374,469 respectively in the corresponding period of 1922-23.

Manchester Steam Users' Association.—The memorandum prepared by Mr. C. E. Stromeyer, chief engineer of the Manchester Steam Users' Association for the Prevention of Steam Boiler Explosions, which has just been published, deals exclusively with the steam boiler clauses of the new Factory Bill. This Bill is the seventh since 1900, and Mr. Stromeyer predicts unhesitatingly that, if a certain provision of the Bill should become law, whereby factory owners would be compelled to alter their steam pipes at great expense, the result would be an annual crop of steam pipe explosions. He also strongly objects to the retention of the undefined expression "competent person" where boiler inspector is meant, more particularly as the Boiler Explosions Act, 1882, provides a far better definition, *viz.*:—"An engineer who is practically conversant with the manufacture and working of boilers." Mr. Stromeyer is greatly alarmed at the powers which the Bill proposes to give to the Chief Inspector of Factories to exempt at his discretion any *type* of boiler from being inspected. Such a clause, he says, would be the strongest possible inducement to manufacturers of boilers to bring pressure to bear on that Government official to grant special favours to boilers of their own make. His chief objection to the Bill is, however, that it complicates a simple subject, that it gives prominence to trivialities and avoids dangerous objects. It is also incomprehensible in parts and, in one case at least, amazingly absurd, where it instructs the "competent person" to report upon every boiler which is unsafe unless repaired within a specified time. Surely, if unsafe, the boiler would be liable to explode long before it is repaired in the specified time. But the memorandum is not merely destructive in its criticism of the Bill; it suggests that the 1901 provision should be adhered to, except that the "competent person" ought to be replaced by "an engineer," and also that factory owners should have some control with regard to the inspection of their boilers.

The Staff Committee's Scope.—An idea of the wide extent of a staff committee's activities is conveyed by some details of the work of the Committee at the Trafford Park Works of the Metropolitan-Vickers Electrical Co., Ltd., published in the July number of the "M-V Club News." Apart from such questions as accommodation, holidays, canteen facilities, and other purely "works" matters, the Committee offers facilities for life insurance, &c.; investigates train and tramcar complaints and has them adjusted where this is possible; arranges for special terms for the purchase by employés of the products of associated companies, including, we notice, *motor-cars*; and it has also secured a special staff trip to the British Empire Exhibition.

Appointments Vacant.—Plumber-Jointers for the Hazel Grove and Bramhall U.D.C., Electricity Department. Mains Clerk of Works for the Borough of Hackney, Electricity Department. Assistant Engineer (mechanical and electrical) for H.M. Office of Works (£260+bonus=£377). Works superintendent for the Aylesbury Corporation Electricity Department. Examiner for the Aircraft Inspection Department (£280). (See our advertisement pages to-day.)

New Cable Ship.—Messrs. Alexander Stephen & Sons, Ltd., launched on August 27th, at Govan, the twin screw steamer *The Cable* for the Eastern Extension, Australasia and China Telegraph Co., Ltd., for service in the Far East, where she will be engaged in laying and repairing the company's telegraph cables. The naming ceremony was performed by Mrs. Wolfe, wife of Mr. R. T. Wolfe, secretary of the Eastern Extension, Australasia & China Telegraph Co., Ltd.

Fatalities.—An inquest was held at Shields, on August 26th, into the death of Ambrose Burrows, an electrician. It was stated in evidence that Burrows was working at the main switchboard of the Castleford Co-operative Industrial Society's premises when he was heard to cry out and appeared to be unable to release himself from the board. The power was cut off, and deceased succumbed a few minutes later. The wires on which he was working were "dead," and it was thought that he must have accidentally touched energised wires. A doctor stated that deceased was burned on both forearms and under the chin. A verdict of "Accidental death" was returned.

John Heywood, a works foreman, of Failsworth, Lancs., received a fatal electric shock on August 27th.

Railway Conference in Berlin.—On September 22nd there will be opened in the vicinity of Berlin an exhibition of railway equipment, and also a joint international conference of railway engineers, promoted by the Society of German Engineers in co-operation with the German State Railways. According to the *Railway Gazette*, the fourth day will be given over to the reading and discussion of papers on electric traction, also electric blocking and signalling plant. The grounds selected for the Exhibition are the shunting yards at Seddin, where there will be an extensive display of steam, fireless, and compressed-air locomotives, ten different types of electric locomotives, and six different types of Diesel engines, with petrol-driven and suction-gas locomotives. A large turbo locomotive will also be exhibited, and it is proposed to arrange visits to German railway works and steel manufacturing establishments.

"Seeing by Wireless."—Mr. W. H. Stevenson, managing director of the General Radio Co., and Mr. G. W. Walton, his colleague, claim to have made an instrument which will transmit photographs at the same speed as that now necessary to maintain persistence of vision in kinematography. This means that 18 pictures a second can be transmitted. "The device is by no means simple in design. It will enable us to see with the same ease as we listen. We already hold patents that cover our instrument." The chief difficulty in the way of television in the past has been the slow action of selenium. The new instrument takes the place of selenium. —*Westminster Gazette.*

Our Personal Column.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Mr. J. V. LEVETT, A.M.I.Mech.E., A.M.I.E.E., has relinquished his position as works engineer to A.C. Cars, Ltd., Thames Ditton, having been appointed electrical engineer to Messrs. Thos. Broadbent & Sons, Ltd., Huddersfield.

On completing the investigation of the New South Wales Government Railways, the Royal Commission, including Sir SAM FAY and Sir VINCENT RAVEN, is to proceed to New Zealand on a similar mission of inquiry concerning the railway and tramway services.

The *Electrical News* (Toronto) reports that Mr. JULIAN C. SMITH has been elected president of the Canadian Light and Power Co., and Mr. JOHN S. NORRIS president of the Quebec-New England Hydro-electric Corporation, both of which are subsidiaries of Montreal Tramways & Power Co., of which Mr. Julian C. Smith was recently elected president.

Mr. C. E. Mason, M.I.E.E., M.I.Mech.E., principal mechanical and electrical engineering assistant to the Rand Water Board, South Africa, has been appointed chief engineer in succession to Mr. W. Ingham, M.Inst.C.E., who died in March last.

Mr. Rufus C. Dawes, brother of General Dawes, has been appointed to assist with the special work entailed by the Dawes reparation scheme. Mr. Dawes has for many years devoted his energies to the organisation and management of electricity and gas undertakings.

Mr. J. Ferguson, formerly chief engineer of the Glasgow Corporation Tramways, has been appointed to represent the Scholey Construction Co., Ltd., in Scotland, in connection with the Sandberg *in situ* rail-hardening process.

Obituary.—Mr. W. H. Tweedy.—The death occurred, at Plymouth, on August 27th, of Mr. William Henry Tweedy, superintendent engineer to the Eastern Telegraph Co.

Mr. F. J. Clarke.—On September 2nd Mr. F. J. Clarke, works manager of the New Gutta Percha Co., Ltd., died suddenly.

New Companies Registered.

Win-Sum Electric Diffusers, Ltd. (200,091).—Private company. Registered August 27th. Capital, £10,000 in 9,500 ordinary shares of £1 each and 10,000 founders' shares of 1s. each. To acquire the benefit of certain letters patent in respect of an invention for diffusing cold or hot air, disinfected or perfumed if desired, or ventilating, and the registered trade mark "Win-sum"; to adopt an agreement with C. A. Wilmart, and to carry on the business of manufacturers of and dealers in machines and apparatus for diffusing cold or hot air, ventilating, electrical engineers, manufacturers of and dealers in electric, magnetic, galvanic and other apparatus and goods, &c. The first directors are:—C. A. Wilmart (chairman) and managing director), 11, The Grange, Wimbledon, S.W.19; W. E. Siday, 43, St. Helens Gardens, North Kensington, W.10; G. A. G. Young, 44, Belgrave Road, S.W.1. Qualification, 1,000 shares of either class. Solicitors: Bateman and Co., 5; John Street, W.C.1. Registered office: 1, Percy Terrace, Hogarth Lane, Chiswick, W.

Cheddar Electric Supply Co., Ltd. (200,017).—Private company. Registered August 23rd. Capital, £5,000 in £1 shares. To establish stations and works and generate, purchase and distribute electrical energy for light, heat, motive power or otherwise, and to adopt an agreement with Burnell Brothers, trading as "Cheddar and District Electricity Supply." The first directors are:—L. A. J. Burnell, The Burrows, Cheddar, garage proprietor; A. E. Burnell, North Street, Cheddar, garage proprietor; L. F. Christy, 51, Broomfield Road, Chelmsford, electrical engineer; C. E. Smith, bristowe, Roxwell Road, Chelmsford, electrical engineer; F. Christy, 53, Broomfield Road, Chelmsford, electrical engineer (chairman). Qualification, £100. Remuneration as fixed by the company. Solicitors: Glyde, Kerslake and Scammell, 17, Small Street, Bristol. Registered office: The Electricity Works, Cheddar.

Ecco Radio, Ltd. (200,019).—Private company. Registered August 23rd. Capital, £3,000 in £1 shares. To carry on the business of electrical, chemical, electrochemical, mechanical, radio and general engineers, &c. The first directors are:—F. L. E. Sangster, Kingsleigh, King's Road, Leigh-on-Sea, seed expert; Mrs. L. Brewerton, Wayside, Chalfont St. Giles, Fucks.; F. H. Brewerton, Wayside, Chalfont St. Giles, electrical engineer. Qualification, £50. Remuneration as fixed by the board. Secretary: E. E. Bishop, 22, Walbrook, E.C. Registered office: Ecco House, Princess Street, Edgware Road, N.W.8.

Reliance Manufacturing Co. (Southwark), Ltd. (200,111).—Private company. Registered August 28th. Capital, £1,500 in 10,000 deferred shares of 1s. each and 1,000 ordinary shares of £1 each. To acquire the stock, plant and assets of the Reliance Manufacturing Co., as carried on at 10, Southwark Bridge Road, S.E., and to carry on the business of mechanical, electrical and general engineers, &c. The permanent directors are:—J. R. Spink, 24, Lansdowne Road, E.17; J. B. Langley, 99, Dulwich Road, Herne Hill, S.E.5. Qualification, 100 ordinary shares. Solicitor: E. M. Tringham, 53, Doughty Street, John Street, W.C.1. Registered office: 10, Southwark Bridge Road, S.E.1.

Official Returns of Electrical Companies.

C. A. Vandervell & Co., Ltd.—Trust deed dated August 18th, 1924 (supplemental to trust deed dated July 23rd, 1919, securing £300,000 debentures), charged on certain properties in Hammersmith and Acton, and 33 debentures of £1,000 each in C.A.V. Small Tools, Ltd. Trustees: National Provincial Bank, Ltd., 15, Bishopsgate, E.C.

British General Radio Co., Ltd.—Issue on July 28th, 1924, of £300 debentures, part of a series already registered.

Pickvance, Ltd.—Issue on August 21st, 1924, of £150 debentures, part of a series already registered.

Traction and Power Securities Co., Ltd.—Trust deed dated August 15th, 1924, to secure £300,000 debenture stock and such further stock as may be issued, not to exceed in the whole the capital of the company for the time being subscribed, charged on the company's undertaking and property, present and future, including uncalled capital (if any). Trustees: Phœnix Assurance Co., Ltd., Phœnix House, King William Street, E.C.

Dewhurst's Engineering Co., Ltd.—Debenture charged on the company's undertaking and property, present and future, including uncalled capital dated August 19th, 1924, to secure all moneys due or to become due from the company to Barclays Bank, Ltd., not exceeding £20,000. Satisfaction in full on August 19th, 1924 (*a*) of debenture dated April 8th, 1918, securing £20,000, and (*b*) of a charge dated July 1st, 1918, securing all moneys due or to become due from the company to the Union Bank of Manchester, Ltd.

Bell Battery and Accessory Co., Ltd. (189,996).—Return dated December 31st, 1923 (filed August 1st, 1924). Capital, £1,000 in £1 shares. Two shares taken up; nil received. Mortgages and charges at date of return, nil. Debenture for £500 secured on the company's general assets, since registered. Return of allotments made up to July 31st shows a further 29 shares allotted for cash.

Dictograph Telephones, Ltd. (134,688).—Return dated May 12th, 1924. Capital, £80,000 in £1 shares. 46,250 shares taken up. £40 6/6 5s. paid. £4,790 considered as paid. £763 15s. remains in arrears. Mortgages and charges (at date of return), £15,000, since discharged.

A. Smethurst & Sons, Ltd.—R. A. Blackford, of 83, Above Bar, Southampton, was appointed receiver and manager on August 20th, under powers contained in debenture dated May 8th, 1924.

City Notes.

Fuller's United Electric Works, Ltd.

The fourth ordinary meeting was held on Friday last at Winchester House, Old Broad Street, Mr. F. R. Wade presiding. In moving the adoption of the report the chairman said that the accounts covered 14 months' trading, being the first period of trading since the reconstruction. They showed a net trading profit of £19,109, and the directors proposed to distribute that profit by the payment of 6 per cent. first mortgage stock interest, absorbing £7,762, to depreciation reserve £7,350, reserve for doubtful debts £2,500, leaving a balance of £1,495 to be carried forward for sinking fund purposes. The period under consideration had been one of many difficulties. When the reconstruction scheme was carried into effect the new directors were faced with the problem of reorganisation, and the need for many economies became apparent. They had succeeded in carrying several economies into effect, with the result that they had a balance sheet which showed a modest surplus carried forward to reserve. The 14 months had been a time of great depression in the industries of the country. The principal manufactures of the company were batteries, cable, and ebonite work. They claimed that their ebonite plant was second to none in the country, and they were able to obtain more orders than they were able to execute, even with the increase of their facilities. The battery plant had been entirely remodelled and considerable economies effected. Their products had been put on a more competitive basis, which gave the company a turnover nearly 60 per cent. greater than it had ever had before. While he wished to strike a note of optimism, he was bound to say that they had great difficulties yet to overcome, and it was only with that determination and strength which the board was putting forward that they could hope to turn their results into profit for the shareholders. They had received about £20,000 from the reconstruction scheme, but against that they had spent £37,000 in reconditioning the plant and the reorganisation, and to carry on their increased turnover it had been necessary to increase their stock. All that had been done out of revenue, and the money they had received from the reconstruction scheme and by the assistance of the bank. He anticipated that this year developments would be shown in the business which would meet with the approval of the shareholders when he was able to place the details before them. The success of the company would be built up steadily and solidly, step by step.—Mr. Bauld, a shareholder, seconded the motion, and the report was adopted after some discussion. —Subsequently extraordinary resolutions were passed altering the articles of association so that in future the directors may raise from time to time such sums of money as they think necessary for the purposes of the company without asking the shareholders to pass a special resolution.

German Companies.

The *Electra Works Company*, of Dresden, which is an investment, supply and constructional undertaking, reports having participated in the formation of the Electrochemical Company, of Hirschfeld, early this year, although the chief scope of activity is centred in electricity supply in Saxony, partly in conjunction with the Saxony State works. The profits earned in 1923 have been carried forward.

The *Mix and Genest Telephone and Telegraph Works Company*, of Berlin, which is the first of the undertakings in the A.E.G. group to introduce its balance sheet in gold marks, has issued a statement explaining how the transposition from the paper mark currency has been carried out. The new balance sheet shows an ordinary share capital of 7,000,000 marks as compared with 4,200,000 marks in 1913, and a reserve fund of 700,000 marks as against 514,000 marks in 1913. It is stated that the larger capital and greater reserve fund are due for the most part to profits arising from the period of inflation and to a considerable reduction in the loan obligations and mortgage debts.

Austrian Companies.

The *Elin Company for the Electrical Industry*, which next to the Austrian Siemens-Schuckert Company, is said to be the most important undertaking in Austria, has declared a dividend at the rate of 2,000 crowns for 1923 as against 500 crowns in 1922. The works have been well employed in the current year on orders for large machines for the State railways and hydro-electric works, and to a smaller extent on industrial installations.

The *Austrian Brown-Boveri Company*, which has decided to pay a dividend of 8,000 crowns per share as against 300 crowns in 1922, reports that the degree of activity in the new financial year is fairly satisfactory. One half of the company's production is exported.

During last week New York bankers issued an Austrian Industrial Loan—the first since the war. The loan, which is for $3,000,000, bearing interest at 6½ per cent., is required for the undertaking of the Lower Austria Hydro-Electric Power Co.

Barcelona Traction, Light and Power Co., Ltd. The revenue of this company during 1923 was $2,726,973, an increase of $151,507. After the deduction of administration and general expenses there remained a balance of $2,572,497. Bond and debenture interest has been paid and the usual provisions for amortisation of bonds have been made. The chief operating companies have made the following reserves: Light and power companies, $764,540; railway company, $102,785. Neglecting the earnings of the companies acquired during the year, the gross earnings of the Spanish enterprises were 4,352,538 pesetas in excess of those of 1922. The lighting and power distribution system was considerably extended during the year, and the hydro-electric undertakings at Tremp and Camarasa were improved.

Ferranti, Ltd. The report for the year ended June 30th last, the first full year since the reorganisation of the capital, records increased profits, these being £55,545 as compared with £36,362 in 1922-23. With £25,163 brought forward a sum of £80,708 is available. It is proposed to transfer £35,000 to general reserve, to pay a dividend of 15 per cent. free of tax (as against 10 per cent.) on the ordinary shares, and to carry forward £27,188. The meeting will be held in London on Thursday next (11th).

French Companies. *La Société de l'Energie Electrique du Rouerge*, in which the *Société des Exploitations Electriques* is interested, is increasing its capital from 30 to 40 million francs.

The report of the *Société Nantaise d'Eclairage et de Force par l'Electricité*, of Nantes, for last year shows a net profit of 3,722,069 fr., as compared with only 1,984,950 fr. in 1922.

Stock Exchange Notices.—Dealings in the following have been specially allowed by the Committee under Rule 159:—

Clyde Valley Electrical Power Co.—300,000 six per cent. preference shares of £1 each, fully paid, Nos. 1 to 300,000; 500,000 eight per cent. second preference shares of £1 each, fully paid, Nos. 1 to 500,000; and 600,000 ordinary shares of £1 each, fully paid, Nos. 1 to 600,000.

The Committee has ordered the shares to be officially quoted.

Chadburn's (Ship) Telegraph Co., Ltd.—The directors report that the year ended March 31st last was an unfavourable one for the company, and it is a matter for congratulation that the balance (£1,202) was on the right side. Agreement has been reached in connection with the company's claims upon the Admiralty, but one or two points remain to be settled. The meeting was to be held yesterday (Thursday).

Companies Struck off the Register.—The names of the undermentioned companies have been struck off the Register and they are thereby dissolved:—

Carbone Arc Lamp Syndicate, Ltd.
Electradomes, Ltd.
M.E.C. Electrical Co., Ltd.
Porous Accumulator Co., Ltd.

Dungarvan Electric Light and Power Co.—In his speech at the annual meeting on August 21st, the chairman (Mr. T. Power) said that the interest on debentures was being paid, but no dividend could be declared. He hoped that it would be possible to pay a dividend next year.

Pinchin, Johnson & Co., Ltd.—The directors have declared an interim dividend of 8 per cent. (actual) on the ordinary shares, as compared with 6 per cent. for the first half of 1923.

International Light and Power Co., Ltd.—It has been decided to pay 6 per cent., less tax, on account of arrears of dividend on the preference shares for the year ended March 31st, 1923.

Pennsylvania Water and Power Co.—The dividend on the common shares for the quarter ending September 30th is $2 per share, as compared with $1½ in 1923.

Brazilian Traction, Light & Power Co.—A quarterly dividend of 1½ per cent., payable on October 1st, has been declared on the cumulative preference shares.

Belgian Company.—The Société Internationale d'Energie Hydroélectrique, Brussels, has decided to raise its capital from 125,000,000 to 162,500,000 fr.

Stocks and Shares.

MONDAY EVENING.

STOCK Exchange markets present a good deal of firmness in the investment departments, and business in various sections round the House is not bad by any means. Even speculation is raising its head, and public interest begins to manifest itself in stocks and shares, in accordance with the usual practice at this season of the year. That there will be occasional alarms in connection with the working of the new Peace pact most people are agreed. But, considered on its broad lines, the Agreement is expected to result in a steady settling-down of European difficulties, and in the promotion of that better international feeling which shall be the first step towards a real return to conditions more nearly approaching Peace.

The admission that the British Empire Exhibition is not likely to fulfil the expectations of Mr. J. H. Thomas and those who were sanguine enough to share his earlier optimism, has had the effect of causing a drop in Metropolitan Consolidated stock. Moreover, the statement, affirmed one day, contradicted the next and again re-affirmed, that the Exhibition will not be opened next year, causes selling of the stock by people who had bought it simply on Exhibition hopes. The result is a fall of 2¼ points to 77, though Districts maintain their price at 52. Underground Electric Income bonds at 96 are ex dividend, which shows no change. Other London traction descriptions continue dull, although London United Tramways debenture is harder at 46½. It is assumed that the new Traffic Bill will make for some closer working agreement between the Underground group, more particularly the London General Omnibus Company, and the tramways. Central London Assented ordinary at 70½ has recovered its dividend of 2 per cent. gross. East London remains at 5, business having been done the other day at 5 3/32. The company's third debenture, in which there has been languid speculation, is quoted 27½ and the fourth at the wide margin of 11-14. The second charge 4 per cent. debenture stock Class "B" stands at 76½, and the "A" stock at 80½.

Cable stocks and shares are very quiet. There is a dullish tendency in the Eastern group, due to the impression that business conditions as a whole are not sufficiently active to favour cable undertakings, and that a revival of industry must be awaited before the companies are likely to improve upon their last-published results. No doubt is expressed, however, as to the ability of the undertakings to maintain their 10 per cent. dividends. Marconis at 1 11/16 are ex the dividend of 2s. per share deducted last Thursday. Allowing for this, there is practically no change in the price. Canadians have fallen upon quiet times and are a shade easier at 6s. 7½d.

Various ex dividend markings in the electricity supply list have had no effect in the way of encouraging business in the shares. St. James' and Pall Mall ordinary are 5s. lower at 12½. Bromptons regained their dividend, being 37s. xd. Urban ordinary rose to 19s., and Edmundsons at 5½ show a gain of the fraction. On a quiet investment demand, Whitehall Electric new preference hardened to 19s., which is 1s. below the issue-price.

Isle of Thanet Electric Tramways 4 per cent. debenture at 73½ is 3 higher than it was a few weeks back, when attention became turned to it as a sound security, with prospects of appreciation in value.

Mexican Utilities are giving a better account of themselves. In particular, Mexican Light and Power preferred has come to the fore with a gain of 5 points. The common are 2 higher. Mexico Trams have not shared, so far, in this improvement, which is said to be due, in part, to American buying. The Brazilian Tramways bonds keep their previously-advanced prices, but Anglo-Argentine Tramways first preference have lost a trifle of their fairly substantial rise.

The cable-construction shares, Henley's, Callender's and British Insulated, are still inclined to be a little dull; Henley's at 2 11/16 xd are 1s. 6d. lower. India Rubber shares, for reasons already mentioned, are 9d. better at 15s., and have changed hands up to 15s. 6d. Edison Swan 5 per cent. debenture was marked down a point to 72½ upon a sale of the stock at 71½. Babcocks are sixpence easier at 47s. 6d., there being uncomfortable doubts as to how far German competition may hit companies engaged in the engineering, iron, coal and steel industries. The rubber share market is uninteresting and neglected.

Continuing the brief selections given here lately of stocks and shares actually on offer in the markets for electrical issues, we may add a list of debenture stocks and bonds, showing the salient features. It is scarcely necessary to repeat that safety of security corresponds with the yields offered, and that the stock which gives the highest return is that, as a rule, which is not ranked amongst the gilt-edged investments:—

Description.	Price.	Yield without redemption. £ s. d.	Interest payable.
Aluminium Corp. 6½% 1st. Mort. Debs. (Registered)	96	6 19 0	J. & D.
Barcelona Trac., Light & Power 7% 50 year Prior Lien "A" Bonds	108½	6 9 6	J. & D.
Bournemouth & Poole Elec. Supply 4½% Deb. Stock	90½	4 19 6	J. & J.
British Automobile Traction 5% 1st Deb. Stock (Scrip) (issued at 95, 15% paid) ...	3 dis.	5 19 6	J. & J. (part div. in Jan., 1925)
Dudley, Stourbridge & District Tract. 6% Guar. Deb. Stock (guaranteed by Birmingham Dist. Power & Traction Co., Ltd.	97½ free.	6 3 0	J. & J.
Isle of Thanet Elec. Supply 4% Deb. Stock	73½	5 9 0	J. & J.
Kent Elec. Power 4½% Deb. Stock	85½	5 2 0	J. & J.
South Wales Power 6% 1st Mort. Deb. ...	101½	5 16 0	J. & D.
Whitehall Electric Investments 6% 1st Mort. Deb. Stock (New)	94½	6 6 0	A. & O. (8 months' div. in Oct.)

Particulars regarding redemption, &c., of the above securities should be obtained before money is spent upon the stocks. The conditions of repayment are somewhat involved in certain instances, and deserve consideration at fuller length than can be given in the above table.

Share List of Electrical Companies.

HOME ELECTRICITY COMPANIES.

	Nom. £	Dividend. 1923.	Dividend. 1923.	Price Sept. 1, 1924.	Rise or fall.	Yield. £ s.
Brompton Ordinary	1	12	10	37/-xd	+9d.	*£5 8 1
Charing Cross Ordinary	1	14	14½	2	—	7 5 0
do. do. do. 4½ Pref.	1	4½	4½	17/6	—	5 2 10
Chelsea	1	10	12	37/6	—	6 8 0
City of London	1	15	15	46/8xd	-9d.	6 9 10
do. do. 6 % Pref. ...	1	6	6	23/-xd	—	5 2 2
County of London	1	10	15	2⅝	—	6 6 4
do. do. 6 % Pref. ...	1	6	6	23/8	—	5 6 8
Edmundson's Ordinary	8	7	7	5⅛	+ ⅛	4 2 4
do. 6 % Pref.	8	6	6	5⅜	—	5 11 7
Kensington Ordinary	5	12	14	9⅜	—	7 9 4
London Electric	1	10	10	80/-xd	—	6 13 4
do. do. 6 % Pref. ...	5	6	6	5⅛xd	—	5 14 3
Metropolitan	1	8½	10	1⅛	—	6 1 3
do. 4½ % Pref.	1	4½	4½	17/-	—	5 6 0
Newcastle-on-Tyne Ordinary ...	1	2½	6	18/9	—	6 8 1
do. 5 % Pref. ...	1	5	5	17/-	—	5 17 8
do. 7 % Pref. ...	1	7	7	25/-	—	5 12 0
Notting Hill 6 % Pref.	10	6	6	9½	—	6 6 4
North Met. Elec. 6 % Pref. ...	1	6	6	1⅛	—	5 6 8
Urban Ordinary	1	—	4	19/3	+1/-	4 4 8
do 6 % Pref. ...	1	5	6	1	—	6 0 0
St. James' and Pall Mall ...	6	14½	17½	12⅝	— ¼	6 18 7
South London	1	11	15	43/3	—	6 18 7
South Metropolitan Pref. ...		7	7	1¼xd	+6d.	5 12 0
Westminster Ordinary	8	12	18	10	—	7 10 0
Whitehall Elec. Invst. 7½ % Pref.	1	7½	7½	19/6	—	7 13 10

HOME RAILS.

Central London Ord. Assented	Stock	4	4	70½xd	+1½	5 13 6
Metropolitan	,,	3½	4	77	—1½	5 4 0
do. District	,,	3	3½	52	—	6 14 7
Underground Electric Ordinary	10	Nil	Nil	2¾	—	Nil
do. do. "A" ...	1	Nil	Nil	8/-	—	Nil
do. do. Income Bonds	5	6		96xd	—	*6 5 0

TELEGRAPHS AND TELEPHONES.

Anglo-Am. Tel. Pref.	Stock	6	6	103½	—	5 16 0
do. Def.	,,	1½	1½	28¾	—	5 5 4
Chile Telephone	5	6	6	5 5/16	—	5 8 0
Cuba Sub. Ord.	10	7	7	7	—	10 0 0
Eastern Extension... ...	10	10	10	16½	— ¼	6 4 0
Eastern Tel. Ord.	Stock	10	10	163½	—1	6 2 4
Globe Tel. and T. Ord. ...	10	10	10	17⅞	—	5 15 3
do. do. Pref.	10	6	6	11½	—	5 6 10
Great Northern Tel.	10	24	22	28	+ ½	7 17 2
Indo-European	25	7	7	32½	—	*5 6 1
Marconi	1	15	10	1 1/16xd	— 3/16	5 18 6
Oriental Telephone Ord....	1	12	12	1⅝	—	*6 3 0
United R. Plate Tel.	5	8	8	6 13/16	— 1/16	*5 17 0
West India & Panama	10	Nil	Nil	1/-	—	Nil
Western Telegraph	10	10	10	16	— ½	6 4 1

HOME AND FOREIGN TRAMS, &c.

Anglo-Arg. Trams First Pref....	5	12½	5½	5⅞	— 1/16	8 3 0
do. do. 2nd Pref. ...	5	5½	6	3	—	10 0 0
do. do. 5% Deb. ...	Stock	5	5	73½	—	6 16 0
British Electric Traction Ord. ...	,,	5	6	90½	+2	6 8 4
do. do. 6% Pref.	,,	6	6	100½	—	5 19 3
Brazil Traction	100	4	4	52	—	7 13 0
Brit. Columbia Elec. Rly. Pcs.	Stock	5	5	80½	—1	5 15 7
do. do. Preferred	,,	8	96/-	82½	—	*5 5 8
do. do. Deferred	,,	8	199 5	105½	+2	*6 3 3
do. do. Deb.	,,	4½	4½	81½	—	5 4 4
Lond. & Sub. Trac. 5 % Pref. ...	1	5	2½	5/6	—	9 1 10
London United Tram. Deb. ...	Stock	4	4	46½	+1	8 12 0
Mexico Trams. 5% Bonds ...	—	Nil	5	66	—	7 11 6
do 6% Bonds ...	—	Nil	Nil	44½	—	Nil
Mexican Light Common ...	100	Nil	Nil	18	+2	Nil
do. Pref.	100	Nil	Nil	44	+5	Nil
do. 1st Bonds ...	—	5	5	60½	+1	8 3 4

MANUFACTURING COMPANIES.

Babcock & Wilcox...	1	20	12	47/6	—6d.	*5 1 0
British Aluminium Ord.... ...	1	5	5	26/3	— ¼	3 16 3
British Insulated Ord.	1	15	15	56/3	—	5 6 9
Callenders	1	15	15	55/-	—	5 9 1
do. 6½ Pref....	1	6½	6½	23/3	—	5 11 10
Crompton Ord.	1	5	Nil	7/8	—	8 17 10
Edison-Swan	4/-	7½	—	4/9	—	8 0 0
do. ,, 5% Deb.	Stock	5	5	72½	—1	6 18 0
Electric Construction	1	10	10	1 7/8	—	6 19 0
English Electric	1	8	5	15/3	—	6 1 2
do. do. Pref.	1	6	6	19/6	—	6 3 1
Gen. Elec. Pref.	1	6½	6½	23/-	—	5 13 1
do. Ord.	1	5	5	18/-	—	5 12 0
Henley	1	15	15	2½xd	—1/6	5 11 8
do. 4½ Pref.	5	4½	4½	4¼xd	+1/6	5 6 0
India-Rubber	1	10	5	15/-	+9d.	*6 13 4
Met.-Vickers Pref.... ...	2	8	8	9⅜	—	8 14 9
Siemens Ord.	1	5	—	1	—	5 0 0
Telegraph Con.	12	20	20	24½	—	*4 17 7

* Dividends paid free of Income Tax.

Market Quotations for Chemicals and Metals.

IT should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general and they may vary according to quantities and other circumstances

CHEMICALS, &c.		Price Sept. 2.	Fortnight's Inc. or dec.
a Acid, Oxalic	per lb.	5½d.	...
a Ammoniac, Sal	per ton	£60	...
a Ammonia, Muriate (large crystal)	,,	£52	...
a Bisulphide of Carbon	,,	...	...
a Borax	,,	£25	...
a Copper Sulphate	,,	£25 10s.	...
a Potash, Chlorate	per lb.	4d. to 4½d.	...
a ,, Perchlorate	,,	4½d.	...
a Shellac	per cwt.	£15 15s.	...
a Sulphur, Sublimed Flowers ...	,,	£7 15s.	...
a ,, Roll	,,	£7 15s.	...
a Soda, Chlorate	per lb.	3d.	...
a ,, Crystals	per ton	£5 to £5 5s.	...
a Sodium Bichromate, casks ...	per lb.	4½d.	...
METALS, &c.			
b Aluminium, Ingots	per ton	£125 to £130	...
b ,, Wire	per lb.	1/9 to 2/6*	...
b ,, Sheet	,,	1/6 to 2/-	...
p Babbitt's Metal and Anti-friction Metal—			
Grade I	per ton net	£231	...
Grade II	,, ,,	£164	...
Grade III	,, ,,	£90	...
c Brass (rolled metal 2" to 12" basis)	per lb.	9½d.	...
c ,, Tubes (solid drawn) ...	,,	1/- to 1/0½	...
c ,, Wire, basis	,,	10½d.	...
c Copper Tubes (solid drawn) ...	,,	1/1½	...
c ,, Bars (best selected) ...	per ton	£94	...
c ,, Sheet	,,	£94	...
c ,, Rod	,,	£94	...
d ,, (Electrolytic) Bars ...	,,	£68	15s. dec.
d ,, ,, Sheets ...	,,	£143 10s.	...
d ,, ,, Wire Rods	,,	£78	15s. dec.
d ,, ,, H.C. Wire	per lb.	9½d.	½d. dec.
f Ebonite Rod	,,	2/- to 3/6	...
f Sheet	,,	2/- to 3/6	...
n German Silver Wire	,,	2/3	...
h Gutta-percha, fine	,,	7/6	...
h India-rubber, Para fine	,,	1/1½	½d. inc.
Iron Pig (Cleveland Warrants) ...	per ton.	£5 2s. to £5 2s. 6d.	...
l ,, Wire, galv. No. 8, P.O. qual.	,,	£25	...
g Lead, English Pig	,,	£34 10s.	5s. inc.
g Mercury	per bot.	£12 15s. to £13.	...
e Mica (in original cases) small ...	per lb.	3d. to 8/-	...
e ,, ,, medium	,,	4/- to 8/-	...
e ,, ,, large ...	,,	10/- to 20/- & up.	...
p Phosphor Bronze, plain castings	,,	1/3½	...
p ,, ,, drawn bars & rods	,,	1/3	...
p ,, ,, rolled strip & sheet	,,	1/3½	...
p ,, ,, wire	,,	1/3½	...
o Platinum	per oz.	£26	...
d Silicium Bronze Wire	per lb.	1/0½	...
r Steel, Magnet, in bars	,,	8d.	...
n Tin, Block (English)	per ton.	£261 15s.-£262 5s.	£4 15s.
n ,, Wire, Nos. 1 to 16	per lb.	3/11	...

*For 1 cwt. lots. Special quotations against definite specifications.

Quotations supplied by

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
l Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p C. Clifford & Son, Ltd.
r W. F. Dennis & Co.

Municipal Tramways Association.—ANNUAL CONFERENCE.—On Wednesday, September 17th, the annual conference of the Association will be opened at the Palace Hotel, Birkdale, Southport, with a civic reception by the Mayors of Southport and Bolton, after which the President, Mr. John Barnard, will deliver his address, and Councillor A. D. Willoughby, chairman of the Hull Tramways Committee, will read a paper on "Tramway Passes." After luncheon, at the invitation of the Southport Tramways Committe, an address on "British as compared with American Methods," will be given by Mr. J. Dalrymple, general manager of the Glasgow Corporation Tramways. Next morning the annual general meeting will take place, and in the afternoon discussions will be held on electrolysis, petrol supplies, &c. The annual dinner will take place at the Palace Hotel in the evening. On Friday, September 19th, the members will visit Bolton and inspect the new power station, and will be entertained at luncheon by the Corporation; the works of the English Electric Co., Ltd., at Preston, will be visited on the way back to Southport.

A Canadian Electric Boiler.—Plans of a new electric boiler have been brought to this country by Mr. F. A. W. Taylor, chief engineer of the Canadian General Electric Co., who arrived at Liverpool on August 31st by the White Star Liner *Canada*. The electrically-heated boiler is 7 ft. 6 in. high and 3 ft. 6 in. in breadth, and is able to generate steam to drive a 150-h.p. engine. The device is to be placed before, and explained to, leading British engineers.

Electric Power: the User and the Price.

By E. G. ROSS, A.M.I.E.E.

BEING now in the midst of a plethora of supply companies' financial statements and reviews, it might be well to give some serious attention to the relationship, to the user, of the electrical power station and its product, with a view to ascertaining, if possible, exactly how the latter will require to function in the near future as regards the sale of energy.

To do so, it is necessary to note several influences now at work affecting the present condition of affairs. The recently-issued Liberal Policy, under the ægis of Mr. D. Lloyd George, respecting coal mines is of the utmost significance to the electricity supply industry in this respect. In brief, it is proposed to build super-power stations in all the vital coalfields, and transform all the stored energy of coal (actual, financial, and moral) into electrical energy, *on the spot where it is found*, and then transmit the transformed power by trunk lines to wheresoever it is now being, or will be, used. The electrical engineer knows well enough the practical saving which would accrue from the adoption of this course (leaving out questions of the possible institution of bureaucracy, &c., for the nonce). What is more, the present private electricity supply company is very much aware of it also. Already, unfortunately, there are rumours in the lay Press, emanating from sources the identity of which may be well guessed, that the scheme is too grandiose, too huge, too impracticable, &c. But not one word, however, is uttered condemning it on the ground of the hard fact of its making electrical energy serve the public at large. This country, as much as most, has huge stores of energy lying about untouched, which can only be harnessed for the good of the general populace by transformation into electrical power. We know this to be a fact. Unfortunately, most of those who are at present responsible for controlling the flow of electrical energy seem *only* to *know* that. Reverting to the above-mentioned financial statements, it is clearly seen that three main items are always mentioned therein. These are—

1. That the directors are very pleased to be able to declare a larger profit than that declared last year.
2. That they are pleased to inform the shareholders that so many more units were sold during the financial year just completed; and
3. That so much is set aside for financial provisions, such as sinking fund, &c.

These three items make up the gist of most reports—just so much and little else. Statements are rarely made relative to the future, other than that "if the present position continues or improves, the directors anticipate a better distribution next year." No mention is made of the responsibility which is held to the public at large. Indeed, one wonders if the average director is fully aware of his possessing any. The foregoing remarks apply even to municipal undertakings, although it must be borne in mind that they do not exist to distribute a dividend.

To look beyond the viewpoints just enumerated, it is very necessary to note that by two men of prominence, each representing large sections of the public in his own sphere, electrical energy is acclaimed as *a necessity*. One of these men has just been mentioned. The other is Mr. Henry Ford, the famous American industrialist. Mr. Ford, setting out to develop the farm, found it first necessary to educate the community to the better use of transport. To do so, he was forced to develop his manufactures in an entirely unprecedented manner. He has since found out that *industrial man*, as distinct from the public represented by Mr. D. Lloyd George, is best served by electrically-operated machinery of all kinds. He further attributes his factory success largely to a clean factory, foundry, and all connected therewith, and admits that that was only rendered fully possible by the proper use of electricity. Here he touches a fundamental note, quite distinct from, albeit intimately attached to, his financial and moral keyboard. What is most important is that, in his biography, he implies, if not definitely states, that the use of electricity *is a fundamental necessity* not only to the factory, but to the whole social system. Well now, we electrical folk *know* it to be a necessity, as distinct from claiming it to be so. Further, the rapid expansion of electrical business of all kinds up to the end of the boom period indicates that the public at large are beginning to realise that electricity *is* a necessity. And we know, that even in the trough of the industrial wave, the electrical trade is generally, busier than most.

The unfortunate thing is, however, that there appears to be no immediate sign of improvement in the present position, although many reports to the contrary are being made. Progress is of a small order really, quite incommensurate with the vastness of electrical possibility. At first sight, one is inclined to blame the present general industrial conditions for the lack of progress. This, however, is much too sweeping. It is true that much may be attributed to the present circumstances, but to do so wholly is to gloss over the most important question of all, and that is: Industrial conditions apart, can the average man *afford to pay* for his electricity? Many will say "Yes," and point to the continued increase in units sold by most companies, as shown in their various statements. This is arguing from the companies' point of view; but things are quite different when the question is looked at from the other side, *i.e.*, from the point of view of the man in the street. He must be classed among the best of potential power users if, indeed, he is not the greatest of them, judging by the results of American investigations. In America the domestic load is going up by leaps and bounds, as against a much slower rate of growth of the industrial load. The point of view of the average man must be considered, therefore, very seriously, and to do so, it is needful to understand clearly just in what respect any certain thing is regarded by him as a *necessity*, for it must be accepted without question that a supply of electrical energy is now a national and universal necessity.

To the average man, under average conditions, a necessity is that which will enable him not merely to live, but to live cheaply, and so enable him to put by for the rainy day, *i.e.*, to make his earnings spin out, as a whole. The truth of this is admitted by all, supply companies included, but the trouble is that not all realise just what a struggle a man in this country has to *live*, far less *save*. The writer has been endeavouring to get hold of some definite data relating to the average earnings, but the search has proved rather difficult. However, from data unearthed, and considering only people whose incomes range between £450 per annum and £100 per annum, it would appear to be the case that the average earnings per working male are round about £200 per annum, say £4 per week. Some will possibly consider this figure to be too high, but it is suggested that it is reasonably accurate. Now, the continued and determined attempt made by supply companies in this country to obtain the custom of the average man is evidence of the importance with which he is regarded. There is, however, a very large "but" involved, which will be quite apparent when it is called to mind that out of his £4 per week, the

average man has to spend somewhat as follows (on the basis of his looking after and supporting a wife and family of three, say):—

Food, not less than	£2	5	0
Rent and taxes, approx. ...	0	15	0
Holidays (say £20 a year) roughly	0	7	6

leaving him twelve shillings and sixpence to cover the hundred and one sundries required by the house, clothes for all, educating his children (no small item this), doctors' and coal bills, *and gas or electricity bills.* One may well wonder how he can afford to pay for electricity at all! Even dropping his holidays, his position is not much easier in this respect. All this may seem to be a useless digression, but really, instead of being so, it gets to the root of the whole matter. It is considered that it is not too much to say that the feeling of "*infra dig.*" arising in the breasts of those mainly concerned, when it is dared to class personal and household economics with a Supply Bill, has very largely been responsible for the comparatively slow rate of increase of domestic load. Hitherto it has been considered to be beneath the ken of a supply company to consider its clients' mode of living at all. That this is a grotesquely fallacious attitude all must admit in the light of the foregoing remarks. If the average man cannot *pay* for electricity, will the demand ever increase as it is fondly expected to do? Let there be no delusion about the matter. Referring to the Salesmanship Conferences of the Electrical Development Association, the cry is almost all the time—from the salesman who really knows from bitter experience—that electrical energy is at present far too dear. The plain fact is that people cannot in the main afford to *use* it, let alone install the necessary apparatus to do so. The suppliers' attitude in the past has been largely a case of, "Oh, well, if he can't afford to pay for it, then he can't have it." This *was* all very well, but now—electrical energy is a necessity, which fact must, and will, not be forgotten. Time was (and indeed still is) when this attitude was one of the curses of the country. The recent cases of the coal and railway strikes are typical examples of its baneful influence. No partisan condemnation is here expressed, but it is simply stated that these troubles were, in the main, caused by a supreme misconception of, or wilful blindness to, the fact that each of these branches of industry constituted a public necessity. In each case, the opposing sides pulled a social tug-o'-war with a necessity as the rope. In the case of the coal strike, did the consumer, in the main, pay for the dearer coal? He did not. He burnt wood or any other fuel that he could lay hands on. Likewise, during the rail strike, he got about by other means, although, by so doing, he suffered no little inconvenience. He did not suffer it long, however, without protesting very strongly. Indeed, it was his protests, or the fear of them, which led to Government intervention in both cases. The moral to be drawn from all this is, that if a *necessity* be denied the man in the street, then he will ultimately take means *to get hold of the necessity in another form.*

Now, there are two ways in which the necessity of electrical energy may be withheld from the public, *viz.*, by industrial strife, and by keeping up the price. Both of these affect the supply of power to a very serious extent indeed. By taking a lesson from Mr. Henry Ford, it must be accepted that if the selling price of a necessity be *properly* adjusted, then industrial strife will disappear. Ford realised that if the average man could not pay for a necessity with an average salary at his back, then the welfare of the community depended entirely on bringing down the price of the necessity *to suit the average earnings.* Who will doubt the success of his application of this principle, in which there is very much more than meets the eye? It means very plainly that the ultimate price of the necessity is *not* fixed by the supplier or controller of it at all, but by the *user.* The not-too-old adage of the price of an article being what it will fetch from the highest bidder, is completely reversed here, and surely rightly so. No man or body of men is morally entitled to set up a system of legalised robbery, which, from the consumer's point of view, is largely what business of all kinds at present appears to be. Ford's profits are, on his own figures, *not more than 3 per cent. on his turnover.* Compare this with the various data now available respecting the costs and charges for electricity. Three per cent. would not look at it.

Again, the bringing down of the price to suit the average earnings means plainly that at least the said earnings shall remain constant. It is useless to bring down the price of a necessity if this is to be done at the *expense* of the earnings which pay for it. Doing so leaves the matter very much as it stood before. The price must be reduced in some other manner. That is to say, the cost of production must be reduced without reducing the wage of the operative. Ford has done and is still doing this, and has shown that it can only be done by applying the most exhaustive of scientific principles to every aspect of production. His production, for example, is divided, sub-divided, and sub-divided again, so much so that even a blind man does something and earns a fair remuneration. He keeps discipline strict; he pays high wages dependent on the work done, with the condition that if the minimum be not earned on one job, the operative is removed to another where he *can* earn it, *i.e.*, the application, in its widest sense, of the principle of the right man for the right job. The skilled man Mr. Ford keeps for *skilled* work, not simply for looking after a machine, which work he relegates to the unskilled worker. Administrative charges he reduces to an absolute minimum, and the directors' fees and expenses, &c., are largely cut out. In short, *every means*, scientific or otherwise, that can usefully cut down oncost relative to turnover is employed by Mr. Ford. No investigation of costs, &c., is regarded by him as too laborious to be undertaken. Every fraction of time must be accounted for and every cent of cost recorded. Very much more Mr. Ford does also, simply because, *his selling price being fixed by his customer*, he is *forced* (willingly, it must be admitted) to do so.

It is thought to be not out of the way to say that his principles *must* be applied to the supply of electrical energy if the industry is to prosper in the future. Primarily, the price of electricity *must* be brought down to suit the average pocket. This means not merely a competition with gas companies as regards price, for they are in exactly the same predicament. Not only must the gas companies' prices be met, but the price per unit of electrical energy must be such as to remove all financial worry from the average man's mind. It does no service to him until it does that at least, for there is no service done if what is done is *accepted* with a grudge. Let there be no dubiety about the matter. If the electricity supply industry is to prosper, it must produce greater, and continually greater, quantities of energy. To do so, it must get rid of that energy as it is produced. It can only do so if the price of the energy is reduced to such a value that *everyone* will use it without worrying about the effect of the bill on the personal balance sheet. (It will be understood, of course, that the mental eye is not here blind to a contributory cause of dear electricity, *viz.*, *dear apparatus to make use of it.*) Withal, the power station must pay its way, which can only follow upon the foregoing if three conditions are fulfilled:—

1. Profits must be a *small* percentage of turnover.
2. Wages paid must at least be kept level.
3. The most exhaustive use must be made of scientific methods of production.

With respect to the last, it might well be said, "Yes, but how?" and it is true that all this is no small order; it is a gigantic proposition. But, surely, it is not beyond the wit of man to accomplish it ultimately? It is now obvious that it is much, very much, simpler, fundamentally, to produce a flow of electrons in quantity than to build motor-cars likewise. In a comparatively short time the country will *demand* elec

tricity at a figure very much less than that now obtaining. New methods of power production will then be *forced* upon the power-station engineer. Who knows but that even the turbo-set may be relegated to the scrap heap? The signs all point that way. Research is even now gradually evolving new methods for the conversion of many forms of energy into electrical energy, and the ideal indicated above may very soon become a living actuality. If, meantime, it is realised fully and clearly just what conditions are now forcing matters to a climax, then a big step forward will have been taken, for it must be remembered that, when the climax does come, as come it will, in the process of electrical evolution, there will be no option available. Drastic action will then be the rule, not the exception.

Relative to the foregoing, the remarkable words of Sir Charles Wakefield, abstracted from his book, "America To-day and To-morrow," which was written after his recent tour of observation, possess a significance of some moment for the supply engineer. Realising that the principles of "Fordism," as he terms it, have become so widely disseminated that the whole structure of American industry has been shaken to its foundations, he says:—

"Once the generality of mankind see it proved beyond cavil that all that is needed can be produced in abundance, our system of struggle and stress will collapse like a pack of cards. We must be ready to replace it; we must be ready to install as a system what Henry Ford and other pioneers in industry, what countless great men and noble women in public life and international crises have practised as a creed—the ideal of 'service first'!"

Here the root of the matter is laid bare—"service first" and always.

Service means the meeting of the customer in every respect.

Price is the *first* respect.

The Costing of Winding and Insulating Coils.—IV.

By F. C. LAWRENCE, M.C., B.Sc.Tech., A.M.I.E.E., A.C.W.A., Chartered Electrical Engineer.

Impregnation.

Perhaps the most important process in the manufacture of coils is the impregnation of the coils with gum.

A number of coils are placed in an open container which is enclosed in a steam-heated tank. They are then heated under reduced pressure for drying purposes, after which the hot molten gum is pumped in so as to immerse them completely. After a few hours of this treatment, under pressure, they are dried and the process is completed.

Assuming the pressure to which the coils are subjected to be constant, the amount of gum absorbed by any one coil depends on its size and the absorption power of its insulation; it is necessary, for correct costing, to arrive at an "absorption" weight for each type and size of coil. This can easily be accomplished by weighing selected coils before and after the operation, the difference being the weight of varnish absorbed less the weight of moisture given up, but this latter amount should be so small as to be negligible; actual tests will show whether this is so or not.

A specimen of each type of coil which is impregnated should be so weighed and a schedule of the absorption weights prepared.

For each impregnation a form should be filled in with the number of each type of coil treated, and during each period the weights of gum consumed should be noted on another form.

From these forms the total number of coils treated during the period can be deduced, and the net absorption of gum figured and compared with the total amount of gum used. The difference between the two weights of gum will represent the wastage and the ratio—gum used to gum absorbed—gives a factor from which the cost of actual gum used can be calculated for each coil.

It might be thought wiser to schedule the amounts of gum which should be used, including an allowance for wastage, instead of merely the gum absorbed, but this would tend to minimise the attention paid to the wastage factor, and the actual amount of gum wasted would not be stated. It is only by knowing the actual wastage that the operations involved are likely to be examined, with a view to cutting down wastage, and the most economical method of procedure can only be found by a study of the relative wastages under certain conditions of pressure, number of coils per container, type of coil, &c.

The labour should be booked to the process number for the period and the cost of labour distributed on the basis of the number of coils treated, for, since they are not

1	Type of Coils.	1	2	3	4	5	6	Total.
2	No. of Coils treated	57	22	321	16	40	139	595
3	Standard Absorption in lb. per coil	3	8	7	20	2	8	
4	Gum absorbed by groups, *i.e.* (2 × 3) ... ... lb.	171	176	2247	320	80	1112	4106
5	Actual Gum used, *i.e.* (4 × 107·7%) ... ... lb.	184	189	2420	345	86	1198	4422
6	Cost, *i.e.* (5 @ 6d. per lb.) ...	£4 12 0	£4 14 6	£60 10 0	£8 12 6	£2 3 0	£29 19 0	£110 11 0
7	Cost of gum per coil, *i.e.* (6 ÷ 2)	s. d. 1 7·4	s. d. 4 3·5	s. d. 3 9·2	s. d. 10 9·4	s. d. 1 0·9	s. d. 4 3·8	s. d. 3 8·6
8	Labour plus Overhead Exp. per coil (See below) ...	10·9	10·9	10·9	10·9	10·9	10·9	10·9
9	Factory Cost per coil, *i.e.* (7 + 8)	2 6·3	5 2·4	4 8·1	11 8·3	1 11·8	5 2·7	4 7·5

Fig. 4.

treated individually, but are impregnated along with a number of other coils, each coil may be assumed to take the same amount of labour.

The card shown in fig. 3 (p. 279), should be completed for each type of coil each period, to give a comparision of the costs.

A numerical example will illustrate the general method of application.

During one week, six different types of coil, the standard gum absorption of which had been previously determined, were impregnated. The numbers of each type of coil treated, the amount of gum absorbed, and eventually the cost of gum used for each type, are tabulated in fig. 4. The gum actually used amounted to 4,422 lb., of which the absorption accounted for 4,106 lb., leaving a wastage of 316 lb., to be accounted for. The ratio 4,422/4,106 or 107.7 per cent. is the factor which, multiplied by the absorption, gives the weight of gum used for each coil. The gum is taken at a cost of 6d. per lb.

The figure for labour and overhead expense is derived as follows:—

Total labour booked to the process ...		£7	5 0
Overhead expense absorbed		19	16 0
Total labour and overhead ...		£27	1 0
Total number of coils treated		595	
Hence the cost of labour and overhead per coil is		10.9d.	

The total factory cost of the process for 595 coils is—

Material	£110	11	0
Labour and overhead	27	1	0
	£137	12	0

And the total charged out to the separate coils—

Type 1	57 @	2/6.3	... ...	£7	3	11
,, 2	22 @	5/2.4	... ...	5	14	5
,, 3	321 @	4/8.1	... ...	75	0	11
,, 4	16 @	11/8.3	... ...	9	7	1
,, 5	40 @	1/11.8	... ...	3	19	4
,, 6	139 @	5/2.7	... ...	36	6	4
595				£137	12	0

The cost of gum used is	£110	11 0	100%
And of the gum actually absorbed is 4,106 lb. @ 6d. per lb., *i.e.*	102	13 0	
A deficit of	£7	18 0	7.14%

which is the cost of wastage due to evaporation, accumulation on the container, and direct wastages.

The cost per coil, as shown in line 9 of the table, would be transferred to cards, such as those shown in fig. 3, each week, and the desired periodic comparisons are thereby forthcoming.

Washers, Rings, and Wedges.

The next section to consider is the cutting-out and shaping of the insulating washers, strips, wedges, blocks, commutator rings, &c.

These can be classified and each class treated separately. Washers for transformers made of fullerboard, fibre and such materials are usually manufactured in fairly large quantities for each job or order. They entail considerable scrap, but it is hardly practicable to weigh the raw material used and the finished product for each size and shape; the finished weight would, however, be obtained for entry on the shipping notes, and the bulk supplies of raw material are, in the normal course of events, charged out of the store by weight, as entered on the requisitions. The amount of scrap cut from the larger sizes and used for the smaller sizes may vary from time to time, and it is proposed that a series of tests should be carried out, to determine the normal usage of material for each group of similar size and type and, from the figures obtained, to find a normal scrap factor for each range of washer. Adding the normal scrap to the finished weight of any washer will then give the weight of raw material which should have been used, and this may be set up as a standard weight for costing purposes.

It is to be noted that there will be much similarity in size, shape and scrap between various ranges of washers, so that it is not necessary to test every one; rather it should be the aim to obtain figures for representative sizes and shapes. This having been done, it is not difficult to fix standards for every size by interpolation.

A list can be made up and circulated, showing, for each style of washer, the standard weight of material used in its manufacture, each different style or type being classified by a descriptive code number.

The cost clerk, who is supplied with copies of shipping notes having the finished weights and the number indicating the style of washer noted on them, can then derive the standard weight and the cost of the material used. The difference between the shipment weight and the standard weight is the standard scrap. The gross actual scrap for all the washers can be obtained by deducting the total finished weight shipped from the gross weight of material used. This figure should agree with the standard scrap, but minor differences will be caused by the using up of greater or less amounts of the original scrap for the smaller sizes. Large differences will, however, denote inefficiencies in manufacture, which will call for immediate investigation.

The standards will need to be reviewed from time to time, so as to ensure that they are a true index of current economic shop practice.

The reason for using standards is that the weighing of the material used for each washer would involve the employment of a man, whose sole duty it would be to weigh-in the material. Even if this were done, no account would be taken of the utilisation of scrap for the smaller sizes, so that, however accurately the material was weighed, the weight of material charged to the process would always be greater than the weight drawn from the stores, by the amount of scrap utilised, and the costs would be inaccurate to that extent. The use of standards prevents this anomalous result, and obviates the necessity of employing a weigh-man.

Were it not for the scrap complication, the material could have been directly charged to orders or jobs, since the quantities used for each job are sufficiently large to warrant individual costing.

The labour, on the other hand, is distinct on each order, and can be booked directly to orders, so that the cost clerk, having calculated the cost of material used, has merely to add the labour from the job tickets to arrive at the prime cost.

Commutator Rings.

The manufacture of commutator rings consists of cutting the required shapes out of specially prepared sheets of micanite, which are moulded in hot moulds to form the rings, separate moulds being used for each size of ring; finally, the rings are trimmed to the correct gauge.

The cutting, shaping, and gauging of these rings can be directly costed to orders, as the material and labour are not only distinct, but of measurable size for each order, so that the cost of any single order or job is derived directly from the requisitions and job tickets booked thereto.

Shocking Fish.—Mr. H. T. Burkey, an engineer of the American General Electric Co., is the inventor of an electric fish stop—a device to save fish from death in irrigation canals, power flumes, and ditches. It is simply the use of electrodes immersed in the canal, with electricity flowing between them. It has been found that the resistance of water to electricity is greater than that of the body of a fish, and that if a fish swims in the vicinity of two or more electrodes it receives a shock which causes it instinctively to dart away. These electrodes are placed there to keep fish from getting into the irrigation canals, where they would die when the water was let out. To prevent this loss, numerous mechanical devices have been tried, but have proved ineffectual. Screens of fine mesh have been used, but if the mesh is fine enough to prevent the small fish from passing through, then the drift and waste carried down by the water clog the meshes so that the water carrying the young fish flows over the top of the screen, and the fish are lost. Another reason why a screen is impracticable is that game fish swim head on to the current and drift slowly down the stream. The tail and fins of the young fish are tender, and large numbers of them become entangled in the screen and die. Other mechanical methods used likewise have met with only partial success.

Some of the Exhibits at Wembley.

Messrs. E. Brook, Ltd.

(*Stand No.* 136, *Avenue* 15, *Bay* 5.)

A prominent feature of this stand is a complete longitudinal section of a 20-h.p., 8-pole, slip-ring induction motor. This machine embodies all the latest developments in construction, is fitted with the firm's standard short-circuiting and brush-lifting device, and is of very substantial construction.

Typical examples of standard induction motors are shown. Crane motors are represented by a 15-h.p. totally-enclosed machine with glass inspection ports fitted over the slip rings and protected by a metal grid. Alternators are typified by a 75-kVA machine for 400 V, 50 cycles, 750 r.p.m., direct coupled to an exciter, which is mounted on an extension bracket from the alternator end shield. This design provides a compact and serviceable machine of medium capacity.

Another exhibit is a large slip-ring induction motor fitted with a third bearing and bed plate, and short-circuiting and brush-lifting gear.

Three machines of a new design, which is being at present made in squirrel-cage protected type only, are exhibited. The features of these machines are their exceptional simplicity and protection. They are fitted with dust-proof terminal covers, and are suitable for general industrial purposes.

A buffing and grinding machine is shown, mounted on a floor stand, with a graduated starter attached. These machines are of the totally-enclosed type, fitted with large overload capacity bearings and independent thrust washers to take all end thrust. The bearing caps which house the thrust washers are of a special design to prevent dust from finding its way into the bearings and machine.

Mining motors of both totally-enclosed explosion and flame-proof, and protected types with explosion and flame-proof slip-ring covers only, are exhibited. These are exactly similar to the mining motors which have been installed in some of the foremost collieries in the country, and are identical with the machines used in the Model Colliery at Wembley.

Two motor-generator sets illustrate the general type required by kinemas and for battery-charging installations; the firm makes motor-generator sets giving from 96 W up to 180 kW.

A medium-size indestructible squirrel-cage cast rotor is exhibited, as fitted in a third bearing machine. The top half of the bearing housings is cut away, and the motor is revolved, showing its mounting on ball and roller bearings. The diameter of the journals is 4 in., and the weight of the rotating piece almost one ton. The whole of this is revolved at about 100 r.p.m. by the smallest motor manufactured by the company, namely, ¼ h.p. A part of the stand is occupied by a model engineering workshop, provided with small

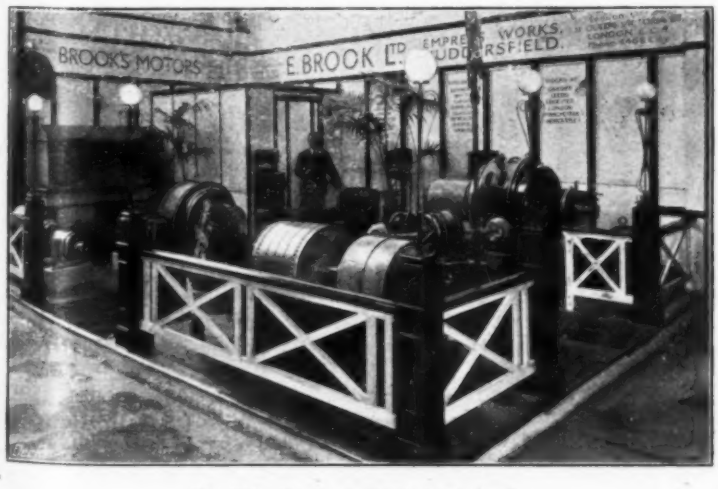

Fig. 197.—Messrs. E. Brook, Ltd.'s Stand.

lathes, presses, drilling machines, planing machines, &c. These are all driven by small motors.

A small overhead travelling crane independently operated by a tiny motor is another item.

In addition to the motors actually on the stand, the company has installed at the Exhibition about 600 h.p. of motors, large and small, driving exhibits of all classes, including boot and shoe making, baking, printing, bookbinding, &c.

The firm also exhibits starters of its own make, including single-phase combined starters which control both stator and rotor circuits of slip-ring machines, three-phase rotor and stator starters, and three-phase, star-delta starting switches. All the above are fitted with automatic release features, and are connected to machines on the stand. A view of the stand appears in fig. 197.

Empson Electrical Engineering Co., Ltd., and Empson Centrifugals, Ltd.

(*Stand No.* 128, *Avenue* 15, *Bay* 15.)

The first of these two companies exhibits the "Dielectrimeter" (fig. 198) for determining the dielectric strength of insulating oils. The instrument has been designed to enable samples to be drawn directly into the testing cell, and to provide an apparatus at a reasonable cost. An induction coil

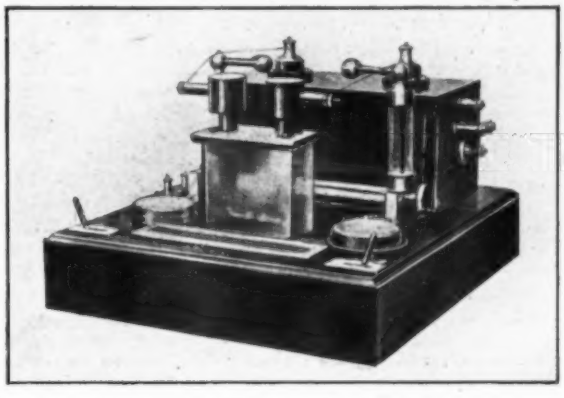

Fig. 198.—The Empson "Dielectrimeter."

is used as the source of high potential, and the testing voltage is regulated by means of a variable spark gap with spherical electrodes, one of which is mechanically connected to a pointer moving over a scale on the base of the instrument immediately in front of the oil-testing cell, the scale being calibrated to read up to 31,000 V. The oil-testing cell is fitted with ¼-in. spherical electrodes, and a gauge is supplied for adjusting these to a 0.15-in. gap as required by British Standard Specification No. 148/1923. On the l.p. side are fitted a fuse, voltmeter, ammeter, and reversing and battery switches. Operation requires about 4½ A at 12 V.

Empson Centrifugals, Ltd., shows its oil purifier. The revolving drum of this machine involves a radical departure from previous practice, having been so designed as to secure a positive washing action, which greatly assists in the removal of microscopic fibres and colloidal carbon, hitherto the most difficult impurities to deal with. The apparatus was recently described in our pages (Feb. 1st, p. 174).

The M-L Magneto Syndicate, Ltd.

(*Stand No.* 1, *Society of Motor Manufacturers and Traders' Section.*)

On this stand a range of magnetos suitable for various sizes of engines, from light motor-cycles to lorries, are exhibited. The other principal manufacture shown is combined lighting and ignition apparatus for motor-cycles. The dynamo portion, as well as the magneto, has permanent fields of cobalt steel. The sets are made for single- and double-cylinder engines and for "V" twin engines. The smaller types have one armature only which performs the dual function of lighting and ignition; the larger types have two armatures geared together.

The firm is also represented by a showcase in the B.E.A.M.A. section (Avenue 14). In this is an air-driven lamp for use in fiery mines. This comprises an air turbine driving a permanent-magnet revolving-field alternator. It has no moving contacts and there is no possibility of sparking. An automatic device cuts off the current if the protecting glass is broken. Another exhibit is an intervalve transformer for radio amplifiers. High-pressure generators and rotary transformers for the supply of h.p. current for radio receivers and amplifiers, and small transmitting sets are shown. These are permanent-field machines which can be supplied complete with smoothing circuits as "anode converters." The exhibit is completed by representative examples of the firm's synthetic resin mouldings for magnetos and radio apparatus.

Modern Navigational Devices.

In the course of an address on the above subject (of which what follows is an abstract) which he delivered before the Royal Institution of Great Britain, Mr. F. E. Smith, C.B.E., F.R.S., described four methods of aiding navigators, the first being the *Leader cable* which enables a vessel to enter harbour in foggy weather. The author pointed out that signals are good up to about 400 yards. To detect the cable at greater distances towed electrodes 100 yards apart have been used; they consist of two insulated conductors forming a single cable, each conductor being terminated at the sea end by a suitably prepared electrode. The resultant effect is that of a towed loop, of which the upper horizontal part is of copper 100 yards long. The other ends of the conductors are connected to the usual receiving apparatus, and as the effective area of the towed loop is comparatively great, the system is a sensitive receiver. With this system detection of a leader cable at more than 1,200 yards is possible.

Unfortunately the initial expense and maintenance charges are considerable; leader cables should be laid out to sea for some 40 miles, as it is in the approach to the channel from the sea that the mariner most needs guidance.

Sub-Aqueous Sound Ranging and the Radio Acoustic Method of Position Finding.—A second method, proposed by Joly, which depends on the transmission of two waves with different velocities, has proved to be exceedingly accurate. The pressure wave of an explosion from a few ounces of guncotton produced under water by a ship is received on three or four hydrophones at known distances apart and connected to a central recording station. If all the instruments do not receive the impulse simultaneously the differences between the times enable the position of the ship to be determined (a mechanical device being used for determining position when the time differences are known) if the velocity of sound in sea water is known. Thanks to the work of Dr. Wood and Captain Browne at the Admiralty station at St. Margaret's Bay the velocity of sound in sea water has been ascertained to be $4{,}756+13.8\,t-0.12\,t^2+3.73\,(s-35)$ (ft./sec.) where t is the temperature and s is the salinity in parts per thousand.

The receivers have single-point contacts which are broken on the arrival of an impulse, but are not affected by the noises of the sea. The contact is restored by an operator on shore. Each shock receiver is connected to a string of the galvanometer, and on a circuit being broken a string is deflected, photographic records of the deflections on which there is a time scale enabling the intervals to be read within 1/100th of a second. The original records are on bromide paper, the development and fixing is automatic, and the "breaks" are visible to the observer within 30 seconds of the shocks being received. In practice a sentry "receiver" a considerable distance out at sea starts the recording mechanism.

Another form of time recorder is the phonic chronometer, due to Dr. Wood and Mr. Ford, which contains one large and three small dials with four pointers, a division on the fourth dial corresponding to an interval of 1/1,000th of a second. The maximum interval it is possible to record is 100 seconds. The breaking of one circuit starts the chronometer and the breaking of a second circuit stops it; three chronometers form a single unit.

When the distance is very great, good direction is obtained, but the distance is a little uncertain. The remedy is a longer base line, or, what is more practicable, a simple automatic arrangement is used whereby the shock of the explosion automatically closes a circuit and transmits a wireless signal, which deflects one of the strings of the galvanometer. As the velocity of the wireless signal is 100,000 times that of sound the interval between the reception of the wireless signal and that of a shock, multiplied by the velocity of sound, gives immediately the distance of the ship from the shock receiver.

With this radio-acoustic method the locations obtained are believed to be more reliable than those obtained by any other method. It has proved accurate and reliable by day and night, in rough seas, in fog, and at all seasons of the year. Of all known methods of locating position in fog this is the most accurate.

Echo Sounding.—There has been a marked tendency to replace the lead and wire by echo-sounding gear. In sea water sound travels about 4½ times as fast as in air, the velocity being approximately 5,000 ft. per second, and an error of 1/10th of a second in timing an echo results in an error of about 250 ft. in the depth. Navigational officers naturally need something better than this.

In this country attention has been paid chiefly to the development of a system depending on the indirect measurement of the time interval, since this principle appears to be more reliable under all conditions than any other system, and because it lends itself more easily to the production of a simple robust and reliable installation.

The source of sound is a steel diaphragm fixed to the hull of the ship and set in vibration at regular intervals by a spring hammer, which is withdrawn from the diaphragm by a solenoid, the circuit of the latter being broken automatically every half-second. The note emitted has a frequency of 1,250 per second, and when immersed in water the diaphragm is heavily damped, so that the energy communicated to it by the hammer is quickly transferred to the water. The receiving hydrophone is a simple microphone enclosed in a rubber body immersed in the water.

In the vessel a ¼-h.p. electric motor running at 1,200 r.p.m. drives two switches through a 10 : 1 reduction gear. Constancy of speed within 1 per cent. is obtained, in spite of large variations in the supply voltage, by the use of a specially designed centrifugal friction governor. One of the switches, which consists of a pair of brushes in contact with a rotating disk provided with an insulating segment, breaks the 100-volt d.c. supply to the transmitter every half-second for a period of about 0.0025 second. The other switch, running on the same shaft as the disk, short-circuits the telephones in the receiving circuit, except as determined by the position relative to the corresponding pair of brushes, of a second insulating segment.

When, therefore, the apparatus is running, no sound will be heard in the telephones unless the insulating segment in the telephone switch happens to open the telephone circuit at the instant when the transmitter is actuated, or at the instant when the echo returns from the bottom of the sea. By simple mechanism the position of the brushes in the telephone circuit can be displaced by hand relative to the corresponding pair of brushes in the impulse circuit, so that an interval of time, proportional to the angular displacement of the

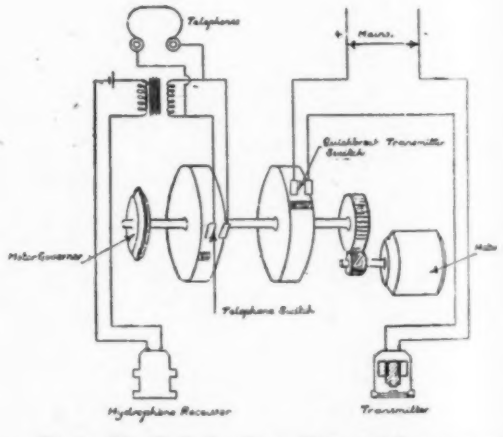

Fig. 1.—Echo Depth Sounding: Diagram of Connections.

brushes, intervenes between the emission of an impulse by the transmitter and the opening of the telephone circuit. If, then, a sound is heard in the telephone, the angular displacement of the brushes gives a measure, in terms of the known speed of rotation of the switch, of the time taken by the sound to travel from the transmitter to the receiver—a distance approximately double the depth of the water. To take a concrete example, the average velocity, over a depth of 30 fathoms, of sound in sea water of 35 per cent. salinity and at a temperature of 15 deg. C., is 4,935 ft. per second. Suppose that the angular displacement of the brushes relative to the insulating segment in the telephone circuit when an echo is heard is 18 deg. The time taken by the segment to rotate through 18 deg. is 18/360ths × ¼ or 1/40th second, since the segment goes round twice per second. In this time the sound will have travelled 123¾ ft., and the depth of water is therefore a little over 10 fathoms. In practice the depth is read directly on a dial. The apparatus is shown diagrammatically in fig. 1.

Directional Wireless.—The author believes this to be the soundest method because of its low cost and general applicability. When the transmission is entirely over sea the resultant errors are small, and the Radio Research Board experiments prove that the causes of all instrumental errors are well understood and can be overcome. The changes due to geographical and meteorological conditions are not understood, but are very serious when the transmission is over land. When the transmitting and receiving stations are comparatively close together the variations are less, but still appreciable. When the transmission is entirely over sea, and the distance between the transmitting and receiving stations does not exceed about 80 miles, the mean variations in the apparent bearings are

within the range ± 2 deg. for both day and night readings. This limit is believed to be sufficiently small to make direction finding reliable enough for many navigational purposes.

The conclusion is that wireless direction finding is unreliable when the transmission is over land, but its reliability for sea work has been definitely proved.

The usual method is to have two or more receiving stations on shore, the transmission being from the ship. The direction is observed at each station, one of which collects the results and estimates the position of the ship. The result is transmitted by wireless to the captain. This method is in use in this country, the Bellini-Tosi receiving system being employed.

For the navigating officer not to determine his position, but rely on the observations of others is not entirely satisfactory, and to overcome this difficulty directional transmission systems have been developed. The short-wave Marconi system is well known, but little has been published of the coil system for directional transmission. Transmission is from a suitably wound coil instead of from an ordinary aerial, and the coil is maintained in rotation about a vertical axis at a constant rate. A maximum amount of energy is radiated in the plane of the coil, and in a perfect system no signals can be received in a plane at right angles to this passing through the axis of the coil. The result is therefore a rotating radio beacon. The ship picks up the signals on its ordinary aerial system, and as the coil rotates the intensity of the signal rises to a maximum and falls to zero, twice in each revolution. When the intensity is zero, the navigating officer knows the plane of the coil is at right angles to him. This information is not sufficient. Arrangements are made therefore for the coil system to transmit a special signal when the plane of the coil is due east and west (north signal), and a second but distinct signal when the plane of the coil is due north and south (west signal). If the officer counts the number of seconds intervening between the north signal and the time of zero intensity, and if the rate of rotation of the coil is known, the direction of the transmitting station is easily calculated. Two such stations—though it is desirous to have more—enable an officer to determine his position. The results so far obtained by the Air Ministry at Farnborough are very satisfactory, and the system is to be tried at sea.

American Commerce and Industry.

A REPORT, dated April, 1924, upon the finance, industry, and commerce of the United States, has been furnished to the Department of Overseas Trade by Mr. J. Joyce Broderick, Commercial Counsellor, at the British Embassy, Washington.*

This is an exhaustive review containing, in addition to a record of the course of events in the financial and industrial spheres, many points of guidance for British manufacturers. For the first time since the war the monthly statements of foreign trade for the period March-June, 1923, showed balances "unfavourable" to the United States, although the balance for the complete year was the other way. The more rapid advance of the import figure than that of exports has led to much discussion of the "self-sufficiency" attitude so widely adopted. One reason for the decrease in the excess of exports over imports, which has fallen from 4,016 million dollars in 1919 to 376 million dollars in 1923, is the decrease in European purchasing power consequent upon the war, and the 1922 Tariff Act has not had the effect which was anticipated, for, according to a report by the First Federal Banking Corporation of New York foreign goods are still purchased in spite of the increased cost.

Government Assistance to Trade.

Several pages of Mr. Broderick's report are devoted to a study of the various ways in which export trade is assisted by the Government. The importance of the functions of the Bureau of Foreign and Domestic Commerce is recognised in a definite manner by the growth in the sums annually allotted for its use. In 1913, its first year of working, it received $159,442, and a sum of $3,165,372 has been budgeted for in respect of next year. The Bureau has representatives at most important trade centres and, in addition, it receives the assistance of the United States Consular Service. Other organisations which are either administered by the Government or receive active assistance are the Pan-American Union, the Inter-American High Commission, and the Federal Trade Commission.

Foreign Trade.

The steady increase in imports is welcomed by a large portion of the community, especially the banks, because of their material interest in a widely-diffused prosperity. The imports from a number of countries declined, but only in the case of Greece was the decrease appreciably large. On the other hand, German imports increased from $117,498,000 to $161,348,000, apart from goods received indirectly from the same source. The value of goods supplied by the United Kingdom rose from 357 million dollars to 404 million dollars. Although much of this was *entrepôt* trade, a highly important part was made up of the products of British factories. Speaking of British goods, not specifically electrical, Mr. Broderick says that they enjoy a reputation for quality, design, and careful workmanship which should secure them a market amongst the growing number of people in the United States to whom quality is more important than price. A hint to manufacturers follows:—"A single agent in an eastern city, unless he controls a wide distributing organisation of his own, can hardly cover satisfactorily the whole area of the United States." It is pointed out that, as a distributing and consuming centre, Chicago is as important as New York, and the States of the Pacific Coast, and, often, the Southern States require the undivided attention of a single agency. Mention is made of opportunities for trade which are occurring in the Pacific Coast and Southern States.

Apart from the general or permanent market in the United States for British manufactures consideration might profitably be given to what may be called the "occasional" demand there for British engineering and metal products and construction material generally. During the early part of the past year, when American factories were overwhelmed with orders, a demand of this character developed in various quarters. These inquiries raise the question whether some joint effort should not be made by a group of British manufacturers to keep in touch with such temporary openings through a carefully selected representative in the country.

The British Empire provides by far the largest market for United States exports. In her general trade with the rest of the world last year the United States had an unfavourable merchandise balance, and it was the great excess of her exports to the British Empire over her imports from it that weighed the total balance so largely in her favour. Great Britain and Canada together took over 36 per cent. of the value of all American exports last year. Great Britain alone took 20.7 per cent. These facts are now being more frequently noticed by American economists, and they provide a material reason for a generally prevailing popularity of British goods amongst American consumers.

A list of exports during 1923 is contained in an appendix to the report. The items are arranged in the order of their value, and electric motors, starters, and controllers at $13,245,000 are forty-eighth in the list; internal combustion engines (51st) are valued at $12,174,000; copper rods (61st) at $9,995,000; electric switches, meters and other transmission apparatus (86th) at $5,937,000; telephone, telegraph and radio apparatus (90th) at $5,263,000; and lead pigs, bars, &c. (96th) at $5,159,000.

The Electrical Industry.

Closing the month of December with a volume of unfilled orders sufficient to keep them working at high pressure for nearly six months the principal concerns engaged in the production of electrical machinery and equipment concluded a very prosperous year, marked by large shipments, well maintained price levels and good profit margins. Sales of radio materials, of electric lighting materials and of household electrical devices were particularly satisfactory. Exports of electrical machinery and apparatus, though still considerably smaller in volume than those of the record years of 1919, 1920 and 1921, showed a notable improvement over the 1922 exports. Their total value in 1923 amounted to nearly 60 million dollars as against 53 million dollars in the previous year. Further improvement in domestic sales are anticipated in view of the continued high degree of activity in the building trades, the expansion of the telegraph and telephone industry, and the remarkable popularity of radio installations. Foreign sales are also expected to increase largely and important manufacturing plant extensions are, therefore, being made by the General Electric Company, the Westinghouse Company, the Western Electric Company and others to cope with the increased demand. It is reported that the General Electric Company has acquired secure control over the Canadian corporation of the same name with a view to expanding the sales of its products in the various parts of the British Empire, obtaining the advantage, wherever possible, of preferential tariff rates. The Westinghouse Electric & Manufacturing Co., for the purpose of consolidating its position in the Japanese market, has participated with Japanese capital in organising the Mitsubishi Electric Manufacturing Company. This new concern will manufacture in Japan under the Westinghouse Company's patents, and will also, it is stated, import supplies of certain kinds from the United States. In the works producing electrical apparatus employment advanced steadily and earnings showed a continued upward trend. In June, 1923, the average

* Stationery Office 3s. 6d. net.

week of plant operation was 48.6 hours. Average weekly earnings were $27.91, 13.7 per cent. above those of December, 1922, and 106 per cent. above the July, 1914, figures.

Metals and Minerals.

The report shows that the iron and steel industry had a prosperous year with steady prices prevailing; at the same time imports were also very large. There was a reaction at the beginning of the current year, but an improved export trade is anticipated.

The American copper mining industry appears to have overcome the worst of its troubles, but it is still wrestling with an unsatisfactory price situation. The production in 1923 was 1,467 million lb. as compared with 989 million lb. in 1922.

The total refinery production from domestic and foreign sources amounted to about 2,110 million lb. as against 1,377 million lb. Both the foreign and the domestic demand improved.

The output of lead, estimated at 550,000 short tons, was the highest since 1916; the apparent home consumption was 580,000 tons The aluminium output was more than double the previous year's production, being valued at 28 million dollars. In spite of tariff protection the tungsten industry was not restored; only two companies reported production in 1923, their joint output being 241 short tons.

The Use of Electrical Energy.

Each succeeding year witnesses a new record in the figures of electricity output. More than 700 million dollars of new capital was placed in the industry in 1923, bringing the total investment at the present time to something like 6,000 million dollars. New construction recently undertaken includes hydro-electric stations which, when completed, will supply 1,500,000 kW and steam stations which will supply about 3,100,000 kW. Of the former the most important is the new 210,000-h.p. station of the Niagara Falls Power Company, and of the latter a 300,000-kW steam plant being constructed at East St. Louis, is the largest. The total output of electrical energy in the United States in the 12 months ended last December was estimated in round numbers at 66 billion—an excess of 26 per cent. over the previous year's total. January, 1924, set another new monthly record with an average output of about 167 million kWh per day.

In view of the extraordinarily favourable results of the principal companies engaged in the industry, of the rapidly increasing use of electric power by industrial plants, and of the growing demand for electricity for lighting and other household purposes a still further large expansion of the industry is anticipated during the present year.

Labour Conditions.

The report states that employment in general continued to be very satisfactory throughout the whole period; indeed, in the spring of 1923 there was something approaching a serious shortage of labour when the manufacturing concerns were at the point of their maximum activity. The wages of employés of nearly all kinds in industrial plants were substantially advanced, in most cases voluntarily by the employers, and this, coupled with a continuing steady demand for factory labour in all the industrial sections, brought earnings well up towards the peak of 1920 and resulted, for the time being, in general industrial peace. Labour efficiency seems to be increasing and wages tend to remain steady in spite of a recent downward trend of the cost of living.

Published Specifications.

Compiled expressly for this journal by Patent Agents.
The name of the applicant's patent agent, if any, will be found on the printed specification.
The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1921.

26,445. "Route-indicating phonic cables." W. A. Loth. October 6th, 1921. (219,726.)

1923.

3,392. "Firing gear of submarine mines." Vickers, Ltd. July 19th, 1922. (201,133.)

5,537. "Power-operated ironing and pressing machine." H. Pierce. April 5th, 1923. (195,941.)

5,890. "Process of electrolytically refining tin bullion." E. C. R. Marks (American Smelting and Refining Co.). February 28th, 1923. (220,012.)

11,494. "Windings on commutating poles of dynamo-electric machines." A. H. Railing and M. L. Kahn. April 28th, 1923. (220,026.)

11,683. "Wireless direction-finding systems." J. Robinson and G. J. R. Joyce. May 1st, 1923. (220,029.)

11,747. "Electromagnetic relays and their application to automatic switches." Automatic Telephone Manufacturing Co., Ltd. (Automatic Electric Co.). May 1st, 1923. (220,033.)

11,748. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd. July 6th, 1922. (Addition to 193,694.) (200,484.)

11,830-2. "Apparatus for electrically translating sound waves into light waves, and for producing a photographic record of such waves." T. W. Case. May 2nd, 1923. (220,040-2.)

11,843. "Receiving circuits for wireless telegraphy, wireless telephony, and like purposes." D. Grimes. September 19th, 1922. (204,301.)

11,901. "Electric incandescent lamps and filaments therefor." British Thomson-Houston Co., Ltd. (General Electric Co.). May 2nd, 1923. (220,045.)

12,011. "Manufacture of inductance coils for use in wireless telegraphy and telephony." F. Akister. May 4th, 1923. (220,047.)

12,151. "Electric time-element devices." A. Reyrolle & Co. and F. N. Linstow. May 5th, 1923. (220,051.)

12,262. "Electrical or other coils, and winding machines therefor." H. Wade (Universal Winding Co.). May 7th, 1923. (220,058.)

12,408. "Method of and means for operating automatically voltage regulators of current rectifiers." G. Rogers and A. T. Thurman. May 9th, 1923. (220,066.)

12,615. "Trolley arms and the like devices for use in electric traction." G. B. Canale. May 10th, 1923. (220,074.)

13,135. "Electric ovens." C. R. Belling. May 16th, 1923. (Cognate application 5,601/24.) (220,090.)

13,401. "Electric primary cells." L. Darimont. May 18th, 1923. (Addition to 180,120.) (220,094.)

14,165. "Method of and apparatus for the magnetic separation of materials." P. C. Rushen (Krupp Akt.-Ges. Grusonwerk, F.). May 29th, 1923. (220,100.)

15,779. "Multiple two-way electric switches." O. D. Edmonds and E. A. Sennitt. June 18th, 1923. (220,114.)

16,000. "Wire-drawing machines." Western Electric Co., Ltd. (Western Electric Co. Inc.). June 20th, 1923. (220,117.)

16,744. "Rheostats." P. W. Baker. June 27th, 1923. (220,124.)

16,821. "Wire-drawing apparatus." Western Electric Co., Ltd. (Western Electric Co. Inc.). June 28th, 1923. (220,127.)

17,351. "Controlling apparatus for parallel-connected electric circuits." R. C. Grasby. July 4th, 1923. (220,133.)

18,147. "Electric cranes." Ransomes & Rapier, Ltd., and P. D. Ionides. July 13th, 1923. (220,138.)

18,557. "Braking systems for motor-driven machinery operating on alternating current." Igranic Electric Co., Ltd. (Cutler-Hammer Manufacturing Co.). July 18th, 1923. (220,145.)

19,587. "Manufacture of electrodes for tungsten arc lamps." General Electric Co., Ltd. December 22nd, 1922. (209,028.)

19,821. "Wireless receivers." Stockall, Marples & Co. (1912), Ltd., and J. J. Stockall. August 2nd, 1923. (220,161.)

20,778. "Electro-magnets." G. Ellison and J. Anderson. August 15th, 1923. (220,166.)

21,674. "Cables with combinable pairs of conductors." Soc. Industrielle des Téléphones (Constructions Electriques Caoutchouc, Câbles). April 26th, 1923. (214,941.)

23,566. "Electric immersion heaters for liquids." J. Schlupek. October 30th, 1922. (206,123.)

24,008. "Variometer coils for use in wireless telegraphy." C. J. Owen. September 26th, 1923. (220,185.)

25,711. "Process for the magnetic separation of materials by the wet method." P. C. Rushen (Krupp Akt. Ges. Grusonwerk, F.). October 15th, 1923. (220,196.)

25,765. "Electric terminal connection." A. Mousley. October 16th, 1923. (220,197.)

29,259. "Acoustical signalling apparatus." H. S. A. Rydberg. November 20th, 1923. (Convention date not granted.) (207,205.)

29,978. "Manufacture of wire, ribbon, or the like of refractory metals." General Electric Co., Ltd. July 14th, 1923. (218,966.)

30,012. "Electric protective devices." Schweiz Glühlampenfabrik, Akt. Ges. April 24th, 1923. (Addition to 203,050.) (214,946.)

30,030. "Sparking plugs." A. F. Collins. November 29th, 1923. (220,207.)

1924.

37. "Manufacture of cathodes for electric discharge tubes." Naamlooze Vennootschap Phillips Gloeilampenfabrieken. January 12th, 1923. (209,780.)

358. "Dynamo-electric machines." Villiers Engineering Co., Ltd., and F. Pountney. January 5th, 1924. (220,224.)

883. "Electric liquid heaters." Soc. Anon. Imexinel. January 20th, 1923. (210,066.)

1,211. "Electromagnetic control systems." M. Fiacchetti E. Sola and Compagnia Italiana dei Segnali. January 15th, 1924. (220,228.)

3,335. "Signalling devices for railway switches." H. Westeson. February 8th, 1924. (220,238.)

4,294. "Radio receiving apparatus." Marconi's Wireless Telegraph Co., Ltd. February 19th, 1923. (221,513.)

4,486. "Incandescent electric lamps and other similar apparatus, and glass-refining apparatus in connection therewith." L. S. Vello. May 12th, 1922. (Divided application on 197,683.) (211,879.)

7,009. "Oscillation generators and modulators." Western Electric Co., Ltd. March 31st, 1923. (213,562.)

12,133. "Frame aerials." Soc. Française Radio Electrique. June 7th, 1923. (217,196.)

Halifax and Its Engineers.—Addresses were delivered on August 26th at a meeting of the Halifax Federated Trades and Industrial Council upon the question of the recent breakdown at the Halifax Power Station by Messrs. J. W. Thomas, assistant general secretary of the Electrical Power Engineers' Association, and Mr. Lunn, of Manchester. After reviewing the negotiations which led to the dismissal of the old technical staff, and explaining what had been done since, Mr. Thomas stated that the Corporation was now paying the salary to the "blackleg" staff that it refused to pay to the old employés who had been in the service for periods varying from ten to twenty years. These men were dismissed, he said, because they would not work for a lower salary than that provided by the National Joint Board—a board which the Halifax Corporation had decided to rejoin. The old staff had stood up for a principle, and were now suffering because the Halifax Corporation had made a mistake. It was said that economy was the reason for the dismissal of the old staff, yet to-day, he declared, the Corporation was paying more in salaries than before the dispute occurred. He thought the Corporation ought to bring back the old staff.—*Yorkshire Observer.*

Italian Railway Electrification.—The Milan Commissioner of the Federation of British Industries says that although much has been said and written regarding the activities of American capitalists and engineering concerns in their endeavour to secure control of the contracts for the electrification of the Italian railways, and the statement has been widely circulated that contracts have definitely been placed with American corporations for certain specific lines, he is in a position to state that, up to the present, contracts have not been let to Americans or to anyone else.